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**Carbon Monoxide Hot Spot Guidelines
Volume VI: User's Manual for the
Modified ISMAP Model**

GCA Corp, Bedford, MA GCA Technology Div

Prepared for

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Volume VI: User's Manual
for the Modified ISMAP Model

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Research Triangle Park, North Carolina 27711**

August 1978

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PREFACE

This document is the sixth in a series comprising the Carbon Monoxide Hot Spot Guidelines. The purpose of this series is to provide state and local agencies with a relatively simple yet accurate procedure for assessing carbon monoxide hot spot potential on urban street networks. Included in the Hot Spot Guideline series are:

- Volume I: Techniques
- Volume II: Rationale
- Volume III: Summary Workbook
- Volume IV: Documentation of Computer Programs to Generate Volume I Curves and Tables
- Volume V: Intersection-Midblock Model User's Manual
- Volume VI: Modified ISMAP User's Manual
- Volume VII: Example Applications at Waltham/Providence/Washington, D.C.

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SECTION 1

INTRODUCTION

This manual describes a version of the Stanford Research Institute ISMAP Model, which has been modified by GCA/Technology Division for the evaluation of carbon monoxide hot spot locations. The purpose of the original version of ISMAP (Indirect Source Model for Air Pollution)¹ was the analysis of the effect of indirect sources such as shopping centers and sports stadiums upon ambient carbon monoxide concentrations in the surrounding area. In modifying the model for application to hot spot analysis, GCA has de-emphasized the role of parking lots while leaving the zone attractions still in the model. Also, street canyon simulation and an emission factor correction routines have been added. The basic structure of the model was, however, not altered. It still provides a convenient mechanism for evaluation of the effects of changes in traffic patterns, zone attractions, signal parameters and roadway characteristics upon carbon monoxide concentrations at selected points.

The basic driving force in the ISMAP model are the trip attractions and productions and their specified distribution among exterior and interior traffic zones. Interior zones are considered to be parking areas surrounded by links of the network. An exterior zone is defined to be an exterior street by which vehicles enter or leave the network. Travel from the network to any interior zone is required to take place through a gate, defined by two links in the network. Based upon link capacities, link to link connections, intersection control type and intersection approach capacities, minimum travel times are calculated for each gate-link combination. This information is in turn used to determine the number of vehicles traveling between an external and internal zone over a number of alternative routes. The program has the capability of handling traffic volumes not generated by zone attractions.

Once the link traffic volumes have been generated by the program, average queue lengths and delay times for each intersection approach are determined ² based upon signalization parameters. By use of the EPA Modal Analysis Model, emission rates for cruising, idling and acceleration-deceleration are assigned to the appropriate sections of the traffic links. These emissions together with hourly meteorological data are input to a line source diffusion model for calculation of hourly carbon monoxide concentrations at selected receptor locations.

Three primary revisions or additions were made by GCA to change the focus of ISMAP from indirect source review to hot spot analyses. These included:
(1) removal of parking lots in terms of their effects on emissions and traffic

flow while still retaining the concept of interior zones, (2) the use of new emission factors, and (3) the incorporation of a street canyon submodel.

In the version of ISMAP developed by GCA, the distinction between internal zones and external zones has been removed, so that internal zones no longer serve as parking lots but simply serve to attract and produce vehicle trips, as do the external zones. The only distinction that remains between internal and external zones is the numbering system that is used to designate each.

Emission factor correction capabilities have been added to permit the user to account for local conditions such as vehicle-age distribution, vehicle-type mix, ambient temperature, region, inspection-maintenance, and percentages of vehicles operating in the cold or hot start mode. These correction factors are computed within the program utilizing the user's specific input parameters, and are applied automatically. The subroutine from which the correction factors are derived was developed from MOBILE1.¹⁴

The user also has the option of utilizing a street canyon diffusion model for analyzing receptors located in street canyons. The particular subroutine available is from the APRAC diffusion model.

One additional modification to the original ISMAP model that was made by GCA was to convert the program code from CDC (Control Data Corporation) FORTRAN to a FORTRAN code compatible with all other computer systems (IBM, UNIVAC, etc.), thereby enhancing the program and increasing its availability.

In the next section of this manual we shall describe in more detail the modified version of ISMAP. This will be followed in Section 3 by a documentation of the individual subroutines in ISMAP. Much of the material for these two sections has been extracted from the original SRI ISMAP User's Manual. The remaining sections contain input data specifications, sample model application, discussion of the use of the program in conjunction with APRAC-1A, a source listing of the program and finally a list of references.

SECTION 2

MODEL DESCRIPTION

The model incorporates three logical submodels for the simulation of (1) traffic flow, (2) vehicle emissions, and (3) pollutant dispersion that, when operated sequentially, produce estimates of air pollution on a fine scale. The functions of the three submodels of ISMAP, and their component subroutines, are described in this section and are illustrated diagrammatically in Figure 1.

TRAFFIC FLOW ANALYSIS

The traffic flow submodel is rerun for each time period that is specified (see flow chart, Figure 2). A time period is specified as an input parameter and a situation is modeled during this time. Accumulations of vehicles in interior zones and queues on streets are retained and during subsequent time periods these act as initialization data for the subsequent iteration. When running a second time period, a new time of day, day of week, number of trip attractions, and number of trip generations must be specified.

Vehicles will select routes between interior and exterior zones that tend to minimize travel time. ISMAP does fine-scale routing of traffic in two steps. In the first step alternative routes from each origin zone to each destination zone are selected. This is done by finding the minimum travel time and route from each zone to each entrance/exit gate and the minimum travel time from each gate to each destination zone. In this process a route is generated between each origin and destination zone and through each gate. Additional routes are generated to a second alternate access link to each interior zone. The four alternative routes that show the minimum travel time are selected from this set.

The second step in the fine-scale routing of traffic is to reassign vehicles to alternate routes between each origin and destination zone. The number of vehicles (v) routed through gate (g) is directly proportional to gate capacity (C_g) and indirectly proportional to the total number of vehicles using the gate (V_g) and the total vehicle trip travel time (TT_g), i.e.:

$$v = K \cdot \frac{C_g}{V_g \cdot TT_g} \cdot T \quad (1)$$

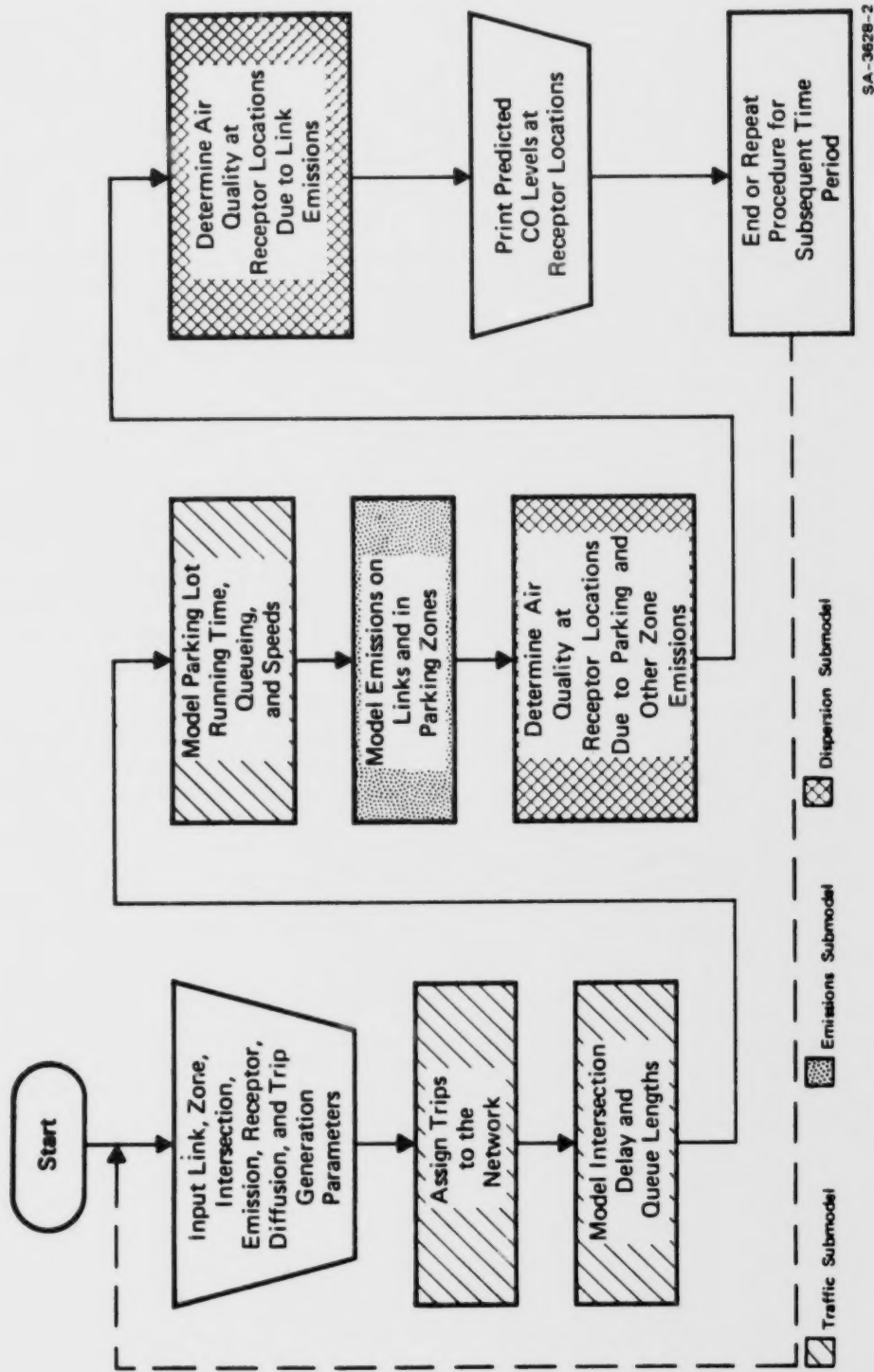
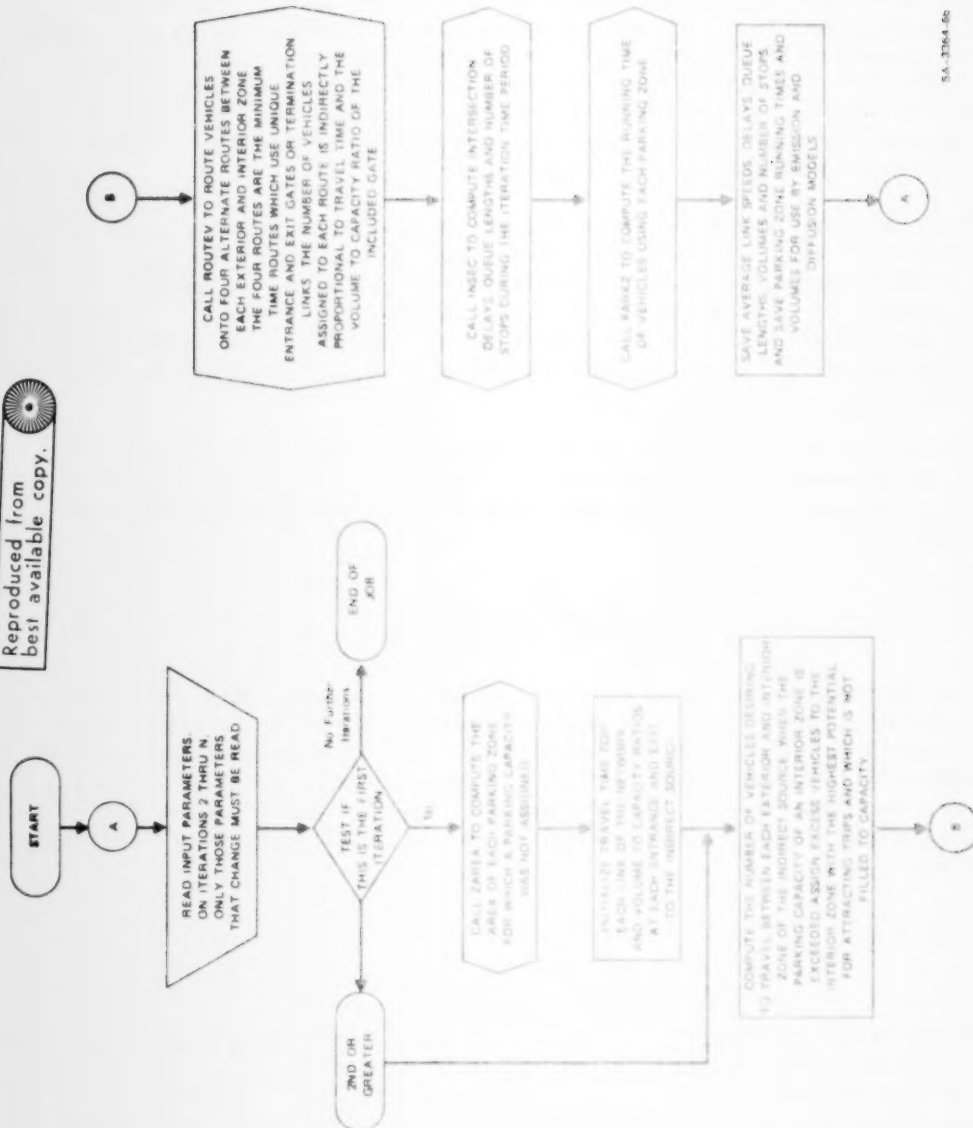


Figure 1. ISMAP flow diagram.



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Figure 2. Flow chart of vehicle flow model.

where T is the total trips being made between the origin and destination zone; and

K is a constant insuring that the sum of the v 's is equal to T .

Traffic is assigned to the alternate routes on the basis of time and capacity; the resulting travel times and other measures of effectiveness, such as stops, delay, queue length, and flow, are then calculated. The delays at each intersection are calculated by a subroutine that models an intersection on the basis of traffic flow and physical characteristics. The outputs of the subroutine are average vehicle delay and average queue length for each approach and turning movement at the intersection.

The method of computing delay at a signalized intersection is based on an approximate method of computing delays and queues³ in which the discrete nature of the cars is disregarded in favor of considering traffic as a continuous fluid, which arrives at a uniform rate (q), is dammed for a time (R), and is then released at a rate (s) until the dam is empty. Traffic therefore moves out of the intersection at the arrival rate (q) provided the green time (G) is long enough.

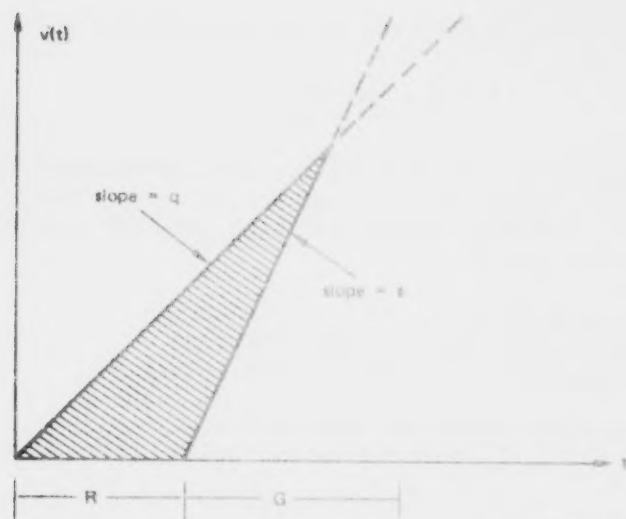
In Figure 3, the variable $v(t)$ is the vehicle arrivals over time t . The total delays for all vehicles during any time interval are represented by the area bounded by the arrival and departure flow rates. The average delay (d) per vehicle is:

$$d = \frac{s \cdot R^2}{2 \cdot (R + G) \cdot (s - q)} \quad (2)$$

Actually, vehicles rarely arrive at a uniform rate but tend to arrive in random small groups. In the model, a Poisson distribution has been assigned to this characteristic, and, when such arrivals occur, queues of vehicles form waiting to be serviced by the intersection. A second element of delay (i.e., queueing delay) must be added to the basic delay (d) caused by the gating of vehicles. This delay is based on the average queue length (Q), which is given by the equation:

$$Q = \frac{q}{\left(2 \frac{G}{R + G} \cdot s - q\right)} \quad (3)$$

Then the average delay per vehicle is the delay due to the gating effect of the signal plus the time spent waiting in the queue of length Q , which is being serviced at a rate $(s \cdot G)/(R + G)$. Combining the delay per queued vehicle (which is the reciprocal of the service rate) with Equation 3 and combining this result with Equation 2, the average delay per vehicle including delay due to queueing (D) is:



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Figure 3. Simple model of intersection delay.

$$D = \frac{s \cdot R^2}{2 \cdot (R + G) \cdot (s - q)} + \frac{q \cdot (R + G)^2}{2 \cdot s \cdot G \cdot (s \cdot G - q \cdot [R + G])} \cdot \quad (4)$$

The intersection submodel will also predict delay and queue length at unsignalized intersections. As with a signalized intersection, a queue may be formed because of random arrivals at the intersection. If q is the arrival rate of vehicles at the intersection and C is capacity flow rate of vehicles departing the intersection, the average queue length is:

$$Q = \frac{q}{(C - q)} \cdot \quad (5)$$

The average delay experienced by vehicles at an unsignalized intersection is:

$$D = \frac{1}{C} \cdot \frac{q}{(C - q)} \cdot \quad (6)$$

The computing delay at an intersection requires predetermination of intersection approach capacity, signal phase lengths, and cycle times. The ISMAP intersection subroutine recomputes these variables for each simulated time period (usually 1 hour) as follows:

- Adjustments to intersection approach capacities are automatically made based on the number of left-turning vehicles at an intersection.
- Red and green phase lengths as well as cycle times are automatically computed at actuated signals.⁴
- Left-turn phases may be specified at a signalized intersection, and capacity for such phases may be input or automatically calculated based on the intersection approach capacity for the through and right-turning traffic.

MULTIMODAL AUTOMOTIVE EMISSIONS ANALYSIS

The emissions submodel of ISMAP is based on a method of calculating the amount of carbon monoxide (CO) produced by specified distributions of light-duty vehicles under four operating conditions: combinations of constant speed, acceleration, deceleration, and idling.² The formulation centers around an instantaneous emission rate $\dot{e}(t)$ that is a function of vehicle speed (v) and acceleration (a). Since speed and acceleration are functions of time, the emission rate function can be expressed as

$$\dot{e}(t) = \dot{e}[v(t), a(t)] \cdot \quad (7)$$

By assuming that the acceleration from/to a given speed is a perturbation to the steady state emission rate, two equations describe the emission rate:



$$\begin{aligned} \dot{e}(v,a) = & b_1 + b_2 v + b_3 a + b_4 av + b_5 v^2 + b_6 a^2 + b_7 v^2 a + \\ & b_8 a^2 v + b_9 a^2 v^2 \end{aligned} \quad (8)$$

$$\dot{e}(v,0) = b_{10} + b_{11} v + b_{12} v^2 \quad (9)$$

where Equation 8 describes the nonzero acceleration emission rate, and Equation 9 determines the steady-state emission rate.

Modified ISMAP first computes the emission rates for three of the four operating conditions (deceleration, acceleration, and cruise) for a 1977 LDV hot stabilized vehicle mix. A correction factor is then applied to adjust the emission estimates to the user specified scenario. The correction factor is basically the ratio of the MOBILE1 emission factor for the specified scenario and the MOBILE1 emission factor for a 1977 LDV hot stabilized vehicle mix. In the case of idle emissions, the MOBILE1 idle emission factor, adjusted for the specified scenario, is used directly.

The emissions model requires the following outputs of the traffic flow analysis for each link:

- Total number of vehicles traveling on the link
- The speed achieved during steady-speed operation
- Total number of vehicles stopped on link
- Total travel time of all vehicles on the link
- Total length of the link
- Acceleration rates.

These inputs are used to describe the CO emissions as a variable (time and distance) along each traffic link. This is done by determining the number of vehicles on each link that are delayed and the number of vehicles that are not delayed. The emissions are then calculated for each group, delayed and not delayed. The emissions for delayed vehicles are determined by calculating the amount of time spent on each link in one of the four operating conditions (constant speed, deceleration, idling, and acceleration) and multiplying this time, along with the number of vehicles involved, by the average emission rate for that specific operating condition. The emissions for those vehicles not delayed are simply the product of the total vehicle-seconds of steady-speed operation and the average emission rate for that speed. A variable emission rate of CO is determined for each link on the basis of this information. This rate varies with distance along the link and depends on the duration and type of each vehicle operating mode. A flow diagram of these calculations is given in Figure 4.

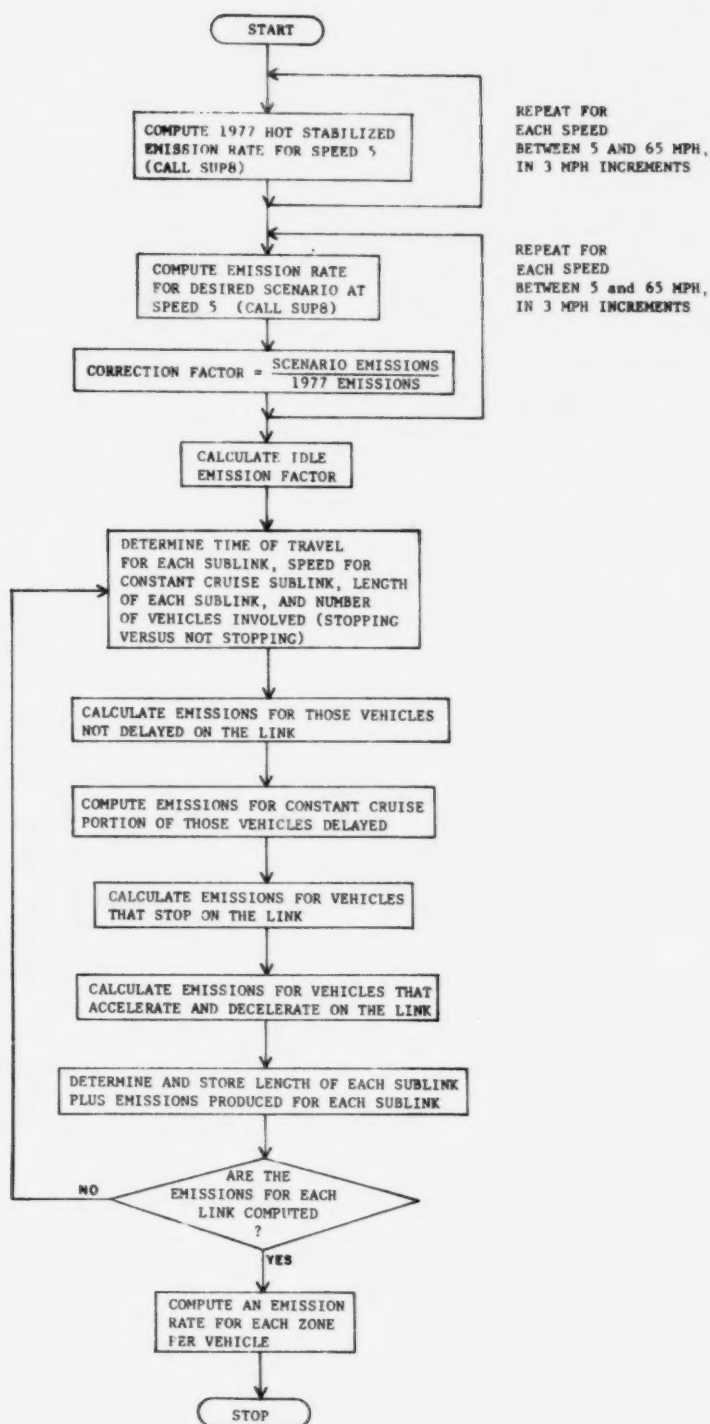


Figure 4. Flow diagram of link emission calculations.

ATMOSPHERIC DISPERSION ANALYSIS

The detailed description of the transport and diffusion of pollutant from individual traffic links necessary for microscale analysis of pollutant distribution is performed by the dispersion submodel portion of ISMAP developed by SRI for this program. Concentrations resulting from line source emissions are calculated separately and summed. Any wind direction may be used, including winds parallel to roadways.

Atmospheric stability may be specified as a model input, or the user may input wind and cloud cover data and allow ISMAP to determine the stability. ISMAP accomplishes this using a table based on modified Pasquill-Turner stability categories.⁷ Atmospheric conditions are classified according to prevailing insolation strength and wind speed for daytime hours, and according to cloud cover and wind speed for nighttime hours, as shown in Table 1.

Figure 5 is a flow chart of the line source calculation procedure in the dispersion model. For each receptor, the location of each link is first tested to determine whether the link contributes to the concentration at the receptor for the input wind direction. This test is made by taking only those links that pass through, or whose end points lie within, a 90° segment extending upwind of the receptor and bisected by the wind vector. If the link does not fall into this pie-shaped slice, concentration calculations for it are bypassed and the next link is checked. If a link does extend into the segment, the model proceeds with calculation of pollutant concentration from the link.

Each traffic link is represented by a series of point sources whose total emissions equal the link's total emissions. A distance between points that will accurately represent the line source must be chosen. The maximum tolerable error resulting from the finite distance between point sources was taken to be 5 percent. Thus,

$$\frac{X_{\text{ref}} - X}{X_{\text{ref}}} = 0.05 \quad (11)$$

where X_{ref} is the concentration at a receptor resulting from some reference point on the link, and X is the concentration of a point on the link a distance ΔL away. The case in which the wind is perpendicular to the link is the most sensitive to the spacing between point sources (ΔL). Assuming the reference point to be on the centerline of the plume with the wind perpendicular to the link, Equation 11 can be solved for ΔL :

$$\Delta L = \sqrt{-2 \ln(0.95) \sigma_y^2} \quad (12)$$

TABLE 1. ESTIMATES OF PASQUILL-TURNER STABILITY CATEGORIES FOR
URBAN AREAS COMPUTED FROM AIRPORT WEATHER OBSERVATIONS

Surface winds (knots)	Daytime (SR* + 4 hours to SS† - 3 hours)			Early a.m. and late p.m. (SR + 1 to SR + 3 and SS - 2 to SS - 1)		Nighttime (SS to SR)	
	Strong insolation	Moderate insolation	Slight insolation			$\geq$ 5/10 clouds	$\leq$ 4/10 clouds
≤ 3	1	2	2	4	5	5	5
3-6	1	2	3	4	4	4	5
6-10	2	3	3	4	4	4	4
10-12	3	3	4	4	4	4	4
≥ 13	3	4	4	4	4	4	4

* SR = sunrise

† SS = sunset

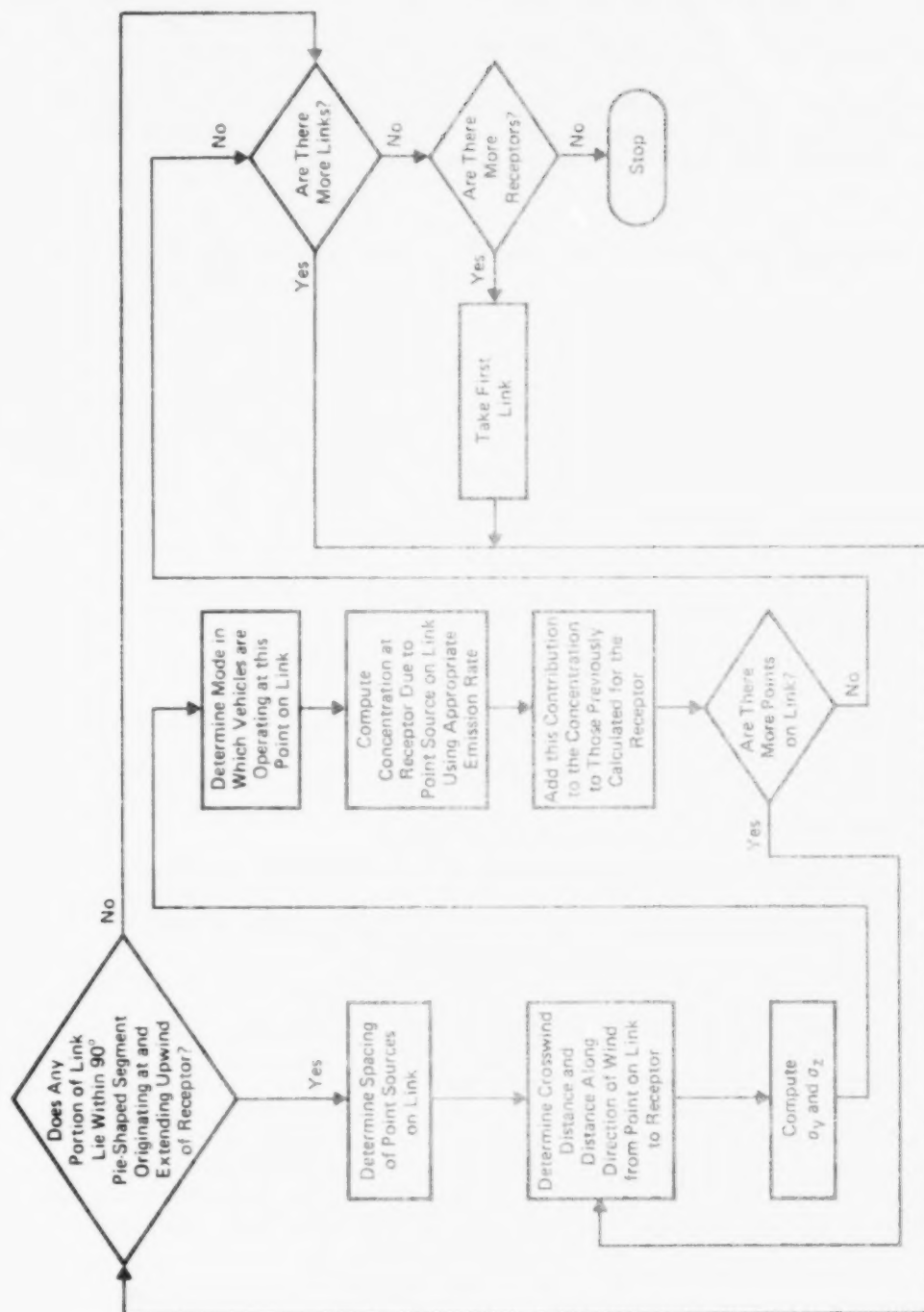


Figure 5. Flow diagram of link dispersion calculations.

The distance along the wind direction used for calculation of σ_y in Equation 12 is the distance from the receptor to the nearest point on each link. To be conservative, ISMAP uses one-half of the value of ΔL as the spacing.

Having found the spacing between point sources for the link, the model proceeds to calculate the CO concentration at the receptor for each point source. The equation for the CO concentration from a point source is

$$\chi_p = \frac{Q_p}{\pi \sigma_y(d_w) \sigma_z(d_w) u} \exp \left\{ -1/2 \frac{d_c^2}{\sigma_y^2(d_w)} \right\} \exp \left\{ -1/2 \frac{H^2}{\sigma_z^2(d_w)} \right\} \quad (13)$$

and

$$\begin{aligned} \sigma_y(d_w) &= a |d_w|^b + c \\ \sigma_z(d_w) &= f |d_w|^g + h \end{aligned} \quad (14)$$

where χ_p is the CO concentration, gm m^{-3}
 u is the wind speed, m sec^{-1}
 Q_p is the point-source emission rate, gm sec^{-1}
 $\sigma_y(d_w)$ is the lateral standard deviation of plume concentration, m
 $\sigma_z(d_w)$ is the vertical standard deviation of plume concentration, m
 H is the emission height, m
 d_c is the crosswind distance from point source to receptor, m
 d_w is the distance along wind direction from point source to receptor, m
 a, b, f, g are the diffusion coefficients and exponents
 c, h are the constants representing initial diffusion, m

For each link, a coordinate transformation of the link end points and the receptor is required to allow the same point source equation formulation to apply to all receptor-link configurations. The crosswind and upwind distances in Equation 13 are then found. The diffusion coefficients and exponents are determined by the stability class: initial horizontal diffusion for links is determined by the point source spacing on the link but is not allowed to exceed the half-width of the link.

ISMAP uses variable emission rates along the link that correspond to different modes of vehicle operation; e.g., steady speed, idling, acceleration, deceleration. When the contribution to the concentration at a receptor from

each point source on the link is calculated, the emission rate used in the calculation is determined by the driving mode being practiced at the location of the point source.

The concentrations resulting from point sources on a link are summed for each receptor and multiplied by the distance between point sources. Then the individual link concentrations are summed to give the total line source concentration at the receptor.

STREET CANYON CALCULATION

The modified ISMAP program provides the option of a special dispersion calculation for those receptors situated near urban roadways with buildings on both sides. The Street Canyon Model⁸ is used only for those link-receptor combinations for which both the link and receptor are associated with a street specified by the user as a street canyon and for which the following relationship holds on an hourly basis:

$$H > 7 \sqrt{\frac{KW}{u}} \quad (15)$$

where H = building height (m)

W = street canyon width (m)

u = wind speed (m/sec)

K = turbulent diffusivity (m^2/sec)

Values for K are 25.5, 5.5, 1.75, 1.0, 0.5 and $0.5 m^2/sec$ for atmospheric stabilities 1 through 6, respectively. Once both of the conditions for a street canyon configuration are met, the concentration assigned to a street canyon receptor will depend upon which side of the street the receptor is located and the direction of the wind with respect to the street orientation. The assignment of a receptor to either the windward or leeward side of the street canyon is illustrated by Figures 6 and 7. For a receptor located at the leeward side of the street canyon the concentration, C_L (g/m^3), is given by

$$C_L = \frac{\xi Q}{(u + 0.5) \left[\left(\frac{W^2}{4} + z^2 \right)^{1/2} + L_o \right]} \quad (16)$$

where ξ = empirical nondimensional constant (≈ 7)

Q = line source emission rate ($g/m/sec$)

L_o = approximate vehicle size ($\approx 2m$)

The windward concentration, C_W (g/m^3), is calculated by the following expression:

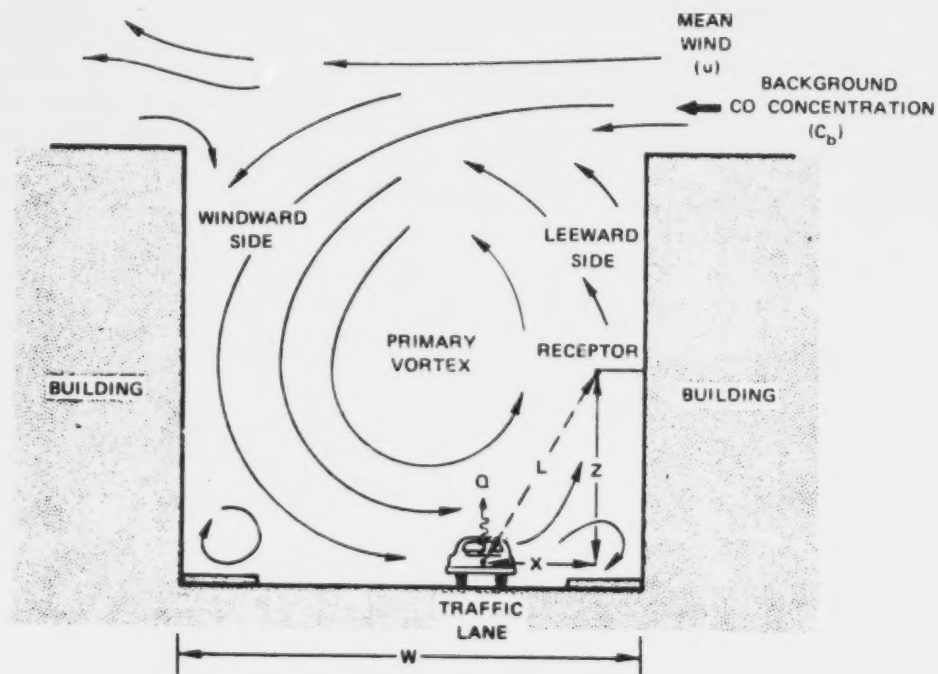


Figure 6. Schematic of cross-street circulation between buildings.

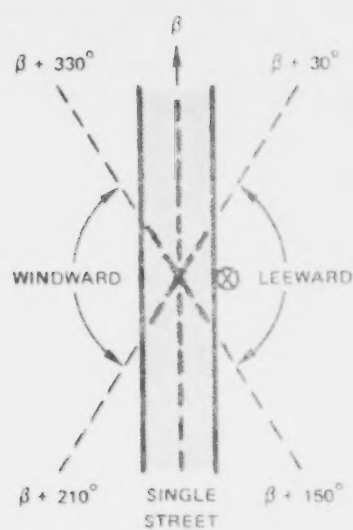


Figure 7. Specification for leeward and windward cases on the basis of receptor location, street orientation, and wind direction.

$$C_W = \frac{KQ (H-z)}{W (u + 0.5) H} \quad (17)$$

If the wind direction for a given hour does not place the receptor either on the windward or leeward side of the street canyon then the concentration is given by

$$C_I = \frac{1}{2} (C_L + C_W) \quad (18)$$

The emission rate, Q , which is used in the Street Canyon Submodel is chosen to be the emission rate due to one of the four modes: cruising, deceleration, idling and acceleration. Each one of these modes is assigned to a different portion of the link. The emission rate which is selected corresponds to that travel mode whose segment centroid lies closest to the receptor location.

SECTION 3

PROGRAM DOCUMENTATION

This section will describe the operation of the ISMAP main program and subroutines. Although a number of the subroutines deal with vehicle routing through parking lots and parking lot area emissions, we present a discussion of these functions for the sake of completeness even though the effects of parking lots upon link volumes and interior zone emissions have been negated within the modified ISMAP.

ISMAP (MAIN PROGRAM)

The ISMAP program acts as a calling program for the various subroutines. The flow chart shown in Figure 1 indicates the calling sequence of subroutines in the traffic flow portion of the model. This is essentially the flow chart of ISMAP except that the link emissions model, EMIT, and the emissions dispersion model, DISPER, are called at the end of the program.

SUBROUTINE INPT

This subroutine is responsible for reading all the data described in Section 4 Inputs Description. The simulation is normally terminated in this routine when an end of file card is read instead of a header card for the next iteration. The INPT routine prints out card images of the data read into the computer and the default values assigned by the program. One exception was made to this rule for card type 9 data. These data are printed out in meters with six coordinate pairs per card image, although it is read in feet as one coordinate pair per card image.

SUBROUTINE ZAREA (EFFECTIVELY BYPASSED IN THE MODIFIED VERSION OF ISMAP)

This subroutine is called to compute the area of a connected figure of up to six sides. The method used is to construct triangles from pairs of connected sides using each side only once. This is done by constructing a third side between the unconnected end points of each pair of connected sides. Two such triangles define the area of any four-sided figure. A five-sided figure is defined by three triangles, two triangles being constructed from the first two pairs of adjacent sides, and the third triangle being constructed by the fifth side of the figure and the two previously constructed sides. A six-sided figure is defined by four triangles; three of these are constructed from pairs of adjacent sides. The fourth triangle is constructed from the constructed sides of the other three triangles. The triangle areas so determined are added to or subtracted from the areas of the other triangles to determine the area of the figure.

Another function of this subroutine is to determine an estimate of the length (PLL) of a trip into the parking zone. The trip length is determined as the length of the longest side plus the computed area divided by the longest side.

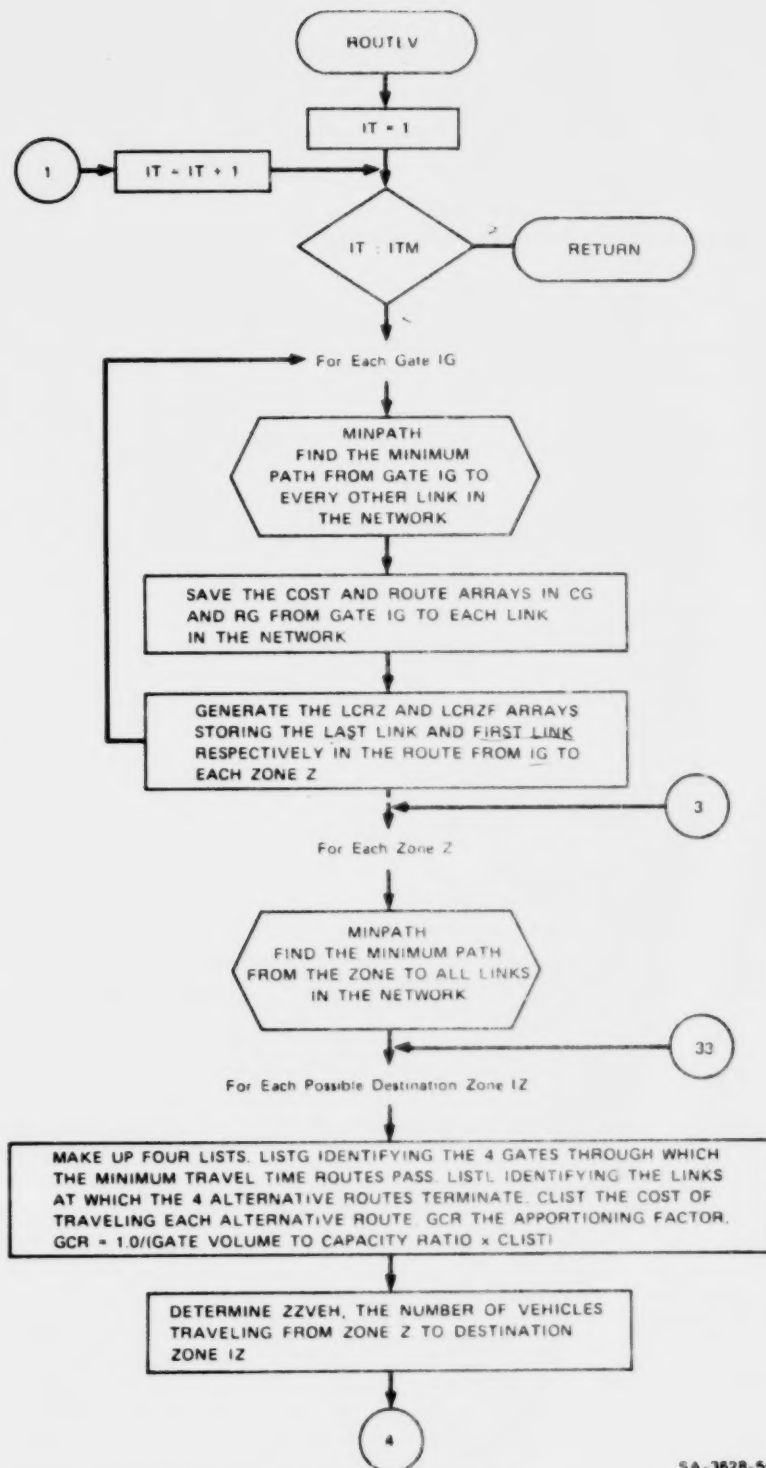
SUBROUTINE ROUTEV

This routine calls the MINPTH subroutine to determine the minimum path between all gates and all other links in the network (see Figure 8 for flow chart). Minimum paths are saved in array RG, and minimum costs are saved in array CG for each gate. The minimum paths are based on travel times for each link by turning movement, which are stored in the TT array. The TT array is initialized with the travel times that would be experienced if all vehicles traveled at the input velocity VEL on each link. Subsequent iterations of ROUTEV use a TT array based on intersection delays and link velocities as modeled by ISMAP.

For each zone, a minimum path and cost are determined to every link in the network and stored in arrays R and C, respectively. Four alternative routes are selected using the RG, CG, R, and C arrays. This is done by finding the minimum route to each gate using the R and C arrays and combining this with the minimum and second most minimum route from each gate to each destination zone. The minimum and second most minimum routes from each gate to each zone are determined from the minimum route and cost to each link that accesses each zone, which is stored in the RG and CG arrays. If four alternative routes are discovered, they may lead through as many as four gates, or as few as two gates, and may terminate on any link that accesses the destination zone. Of course, when less than four alternative routes are possible, only the number of possible alternative routes is generated. When there is no alternative route between external and internal zones, the program fails to apply traffic demand between these zones to the network. If an alternative route does not pass through a gate, the program will fail with an arithmetic error when it tries to compute the number of vehicles using that route (i.e., the sum of the gate volume to capacity ratios, GCRT, will equal zero).

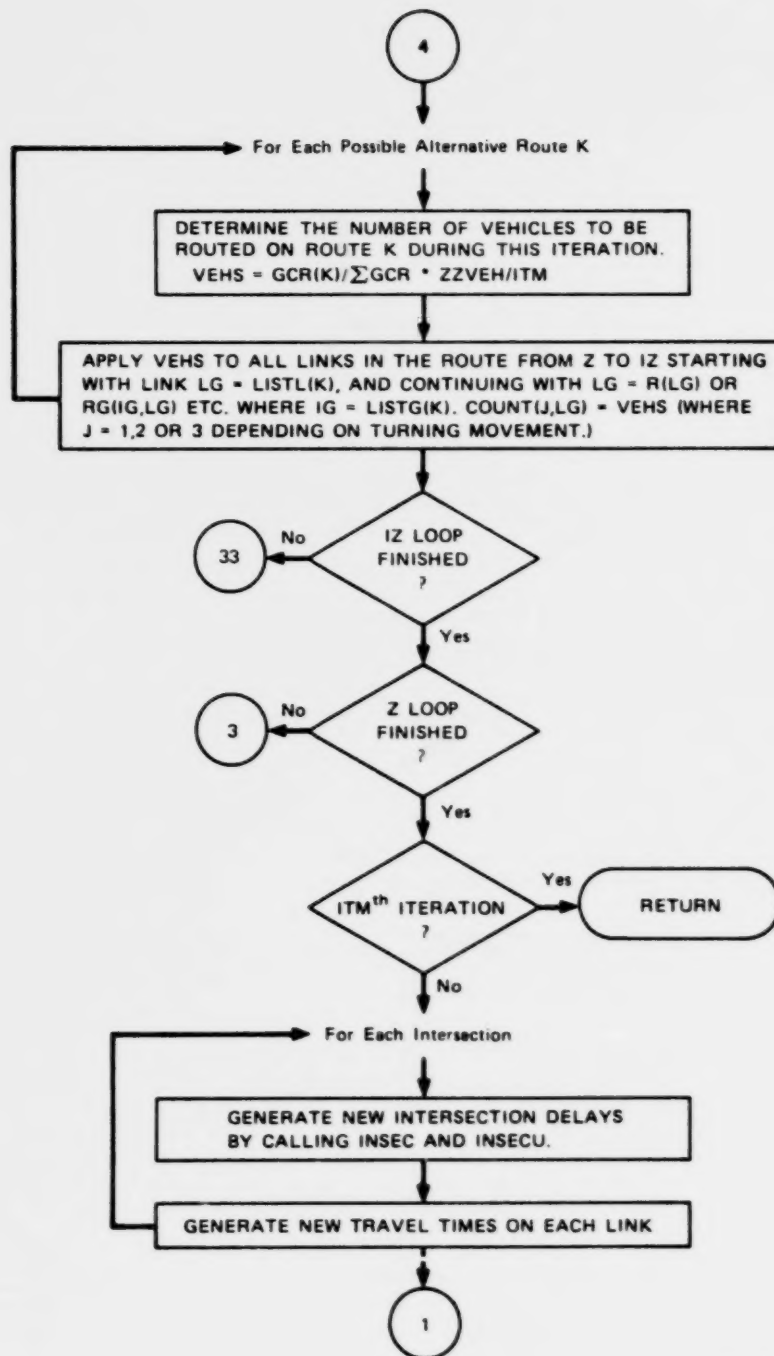
Vehicles are applied to the links of each alternative route in inverse proportion to gate volume to capacity ratio (GCR), route travel time ($C + CC$), and the number of iterations specified for the route selection process (ITM). The procedure outlined above is followed until $1/ITM$ of all vehicles have been routed between all internal and external zones. If ITM is greater than 1, new travel times are determined on all links, a new set of alternative routes is generated, and vehicles are applied to these routes.

This subroutine is responsible for generating the minimum path between each origin and destination zone in the network. The method generates the minimum path from one origin AA to all links of the network. (Recall that a link is one direction of flow on a street and has a load point halfway between each end.) Two arrays are initialized before calling MINPTH. The $TT_{l,j}$ array represents the travel time from link l to a connected link j . The C_l array represents the cost of travel from the origin zone to any link l of the network. The C array is initialized to zero for any link connected to the origin zone and to infinity for any unconnected link.



SA-3628-5a

Figure 8. Route vehicles model flow diagram.



SA-3626-5b

Figure 8 (continued). Route vehicles model flow diagram.

SUBROUTINE MINPTH

The algorithm described below is carried out using these two arrays. On completion, the C_ℓ array represents the minimum travel time (or cost) from the origin zone to each link ℓ of the network. During this process, the R_ℓ array is generated, which contains the link number that immediately precedes link ℓ in the route from the origin to ℓ . The following is a step by step description of the algorithm for route generation.

- Step 1 - Initialize $TT_{\ell,j}$ with the constant cost in traveling from link ℓ to three possible adjacent links,
 $j = j_1, j_2, j_3$.
- Step 2 - For an origin zone initialize with a large number the cost, C_ℓ , to travel from the origin to each link in the network ($C_\ell = \infty$ for all ℓ).
- Step 3 - For the links adjacent to the origin zone store a travel time cost in C_ℓ ($\ell = \ell_1, \ell_2, \dots, \ell_{12}$).
- Step 4 - Set the travel time costs of Step 3 negative, to flag that all links connected to these may have an improved travel time cost.
- Step 5 - Find a negative C_ℓ and the connected links j_1, j_2, j_3 to link ℓ . If no negative C_ℓ exists then do Step 9. If no connected links exist then do Step 8.
- Step 6 - For each $j = j_1, j_2, j_3$ test $|C_\ell| + TT_{\ell,j} < |C_j|$. If the relationship does not hold true then do Step 7. Otherwise replace C_j by $|C_\ell| + TT_{\ell,j}$ and set C_j negative. The route is saved by storing the previous link to j (i.e., $R_j = \ell$).
- Step 7 - Repeat from Step 6 until all j 's have been tested.
- Step 8 - Set C_ℓ to $|C_\ell|$ and repeat from Step 5.
- Step 9 - The C_ℓ array is the cost of travel from the origin to each link ℓ . Repetition from Step 2 will generate new costs of travel from other origins.

SUBROUTINE INSEC

This subroutine computes delays and queue lengths at signalized intersections within the simulated network (see Figure 9 for flow chart). Three types of signal controllers can be specified. The first type is a fixed-time controller in which the north-south, east-west, and left-turning phases are all of fixed time length. The other types of controllers are vehicle-actuated, for which types the INSEC routine must determine the length of each signal

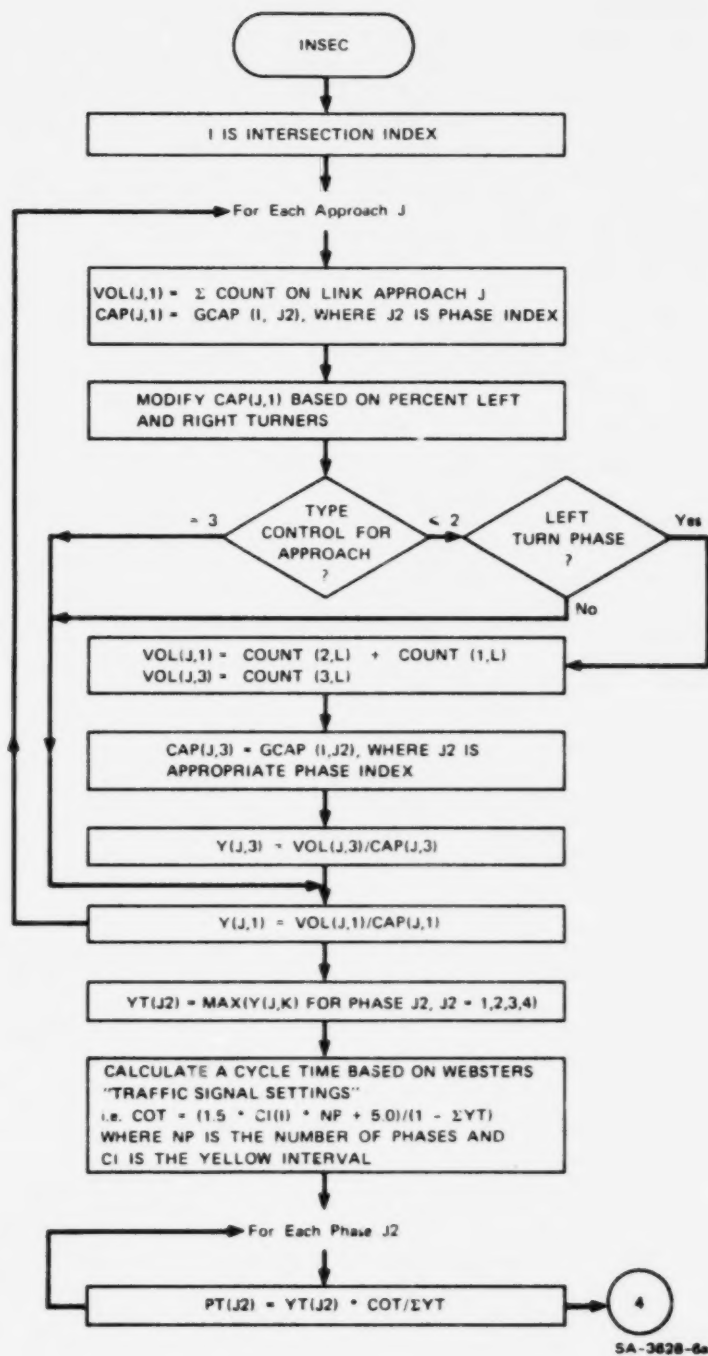
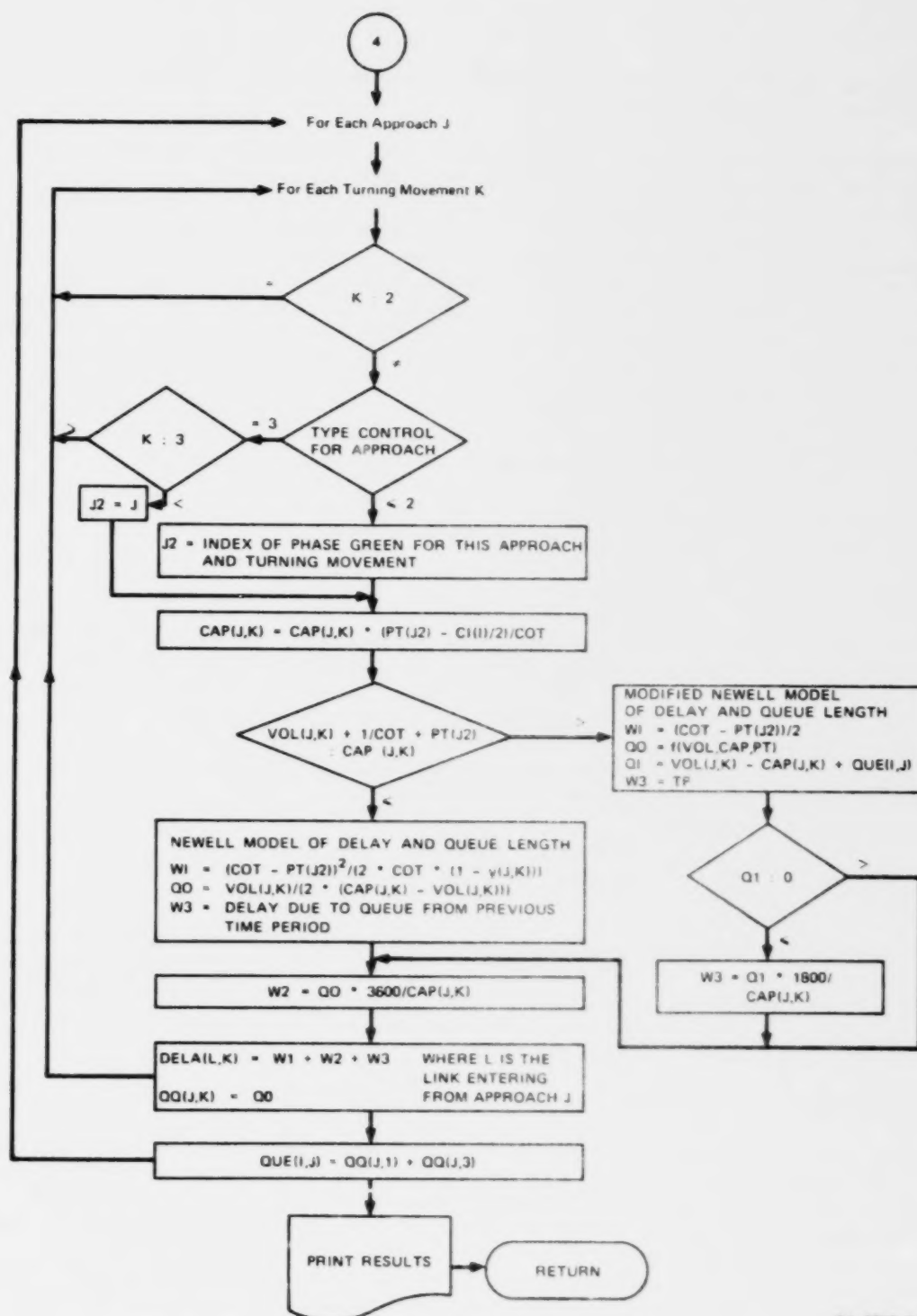


Figure 9. Signalized intersection model flow diagram.



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Figure 9 (continued). Signalized intersection model flow diagram.

phase. Phase lengths are determined based on volume to green capacities of each approach to an intersection.³

Delays and queue lengths are determined at an intersection on the basis of phase time, approach volume, and capacity. The referenced method of determining delay assumes a period of time during which traffic demand remains constant, and does not include a means of estimating queueing when volume exceeds capacity. For ISMAP a method was devised to provide continuous functions for delay and queue length when volumes approach or exceed the intersection approach capacity. This method establishes a constant rate of increase in queue length beyond the point where average delay at the intersection equals one cycle length. The queue is assumed to increase at a constant rate beyond this point until volume exceeds capacity, at which point the queue increases at the rate that volume exceeds capacity. A queue is dissipated at the rate that capacity exceeds volume until the average queue length, based on the volume to capacity ratio of the intersection approach, is reached.

The results of the model, stored in the DELA and QUE arrays, are delay and queue length for each approach to an intersection.

SUBROUTINE INSECU

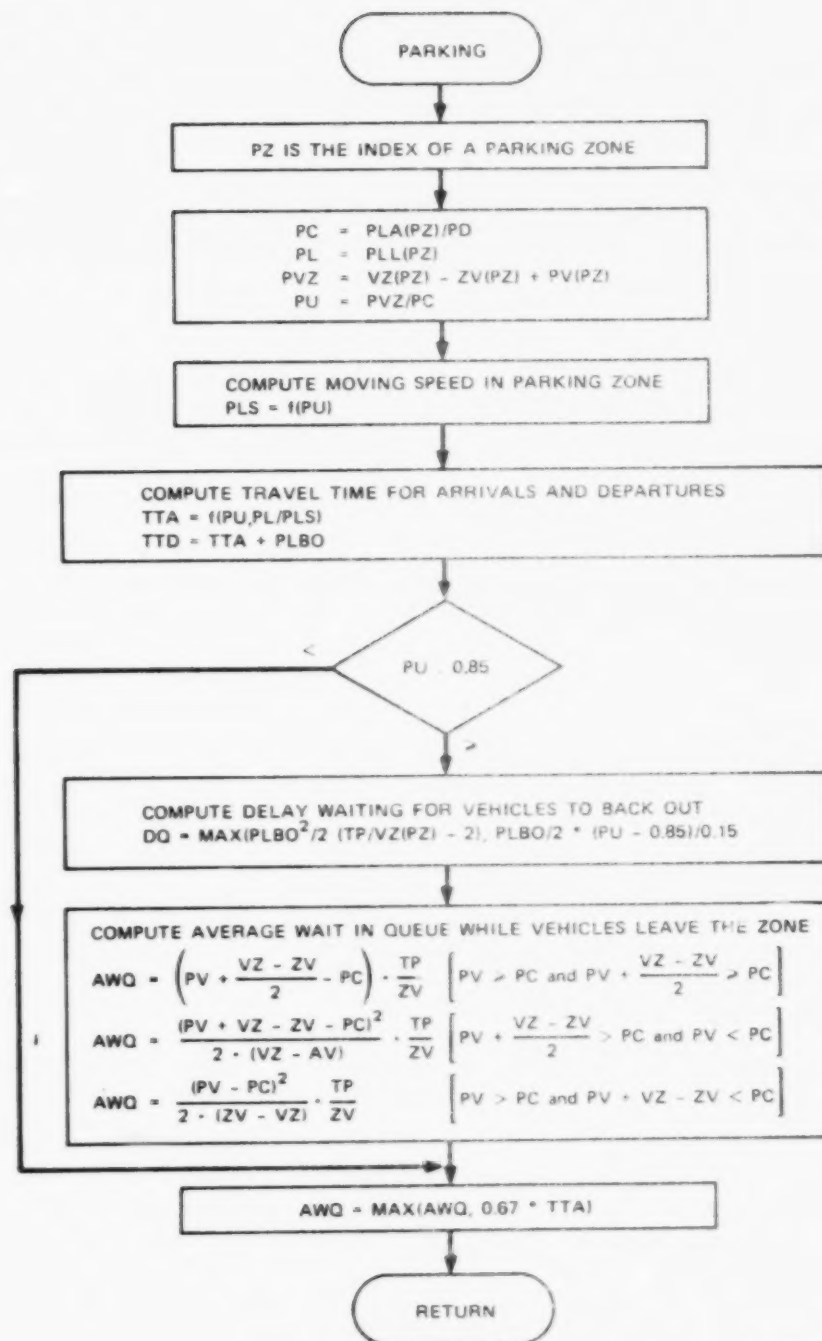
This subroutine predicts the delay and queue length at unsignalized intersections in the network. Three types of intersections can be handled: uncontrolled, two-way stop, and four-way stop. If not specified as an input parameter, the INSECU routine determines an intersection capacity based on the Highway Capacity Manual.⁹ For two-way stops and uncontrolled intersections, the HCM recommends that capacity be computed as if a signal were present and as if the signal split ratio equaled

$$\frac{\text{Volume}_1}{\text{Volume}_2} \times \frac{\text{Width}_2}{\text{Width}_1} \quad (19)$$

At four-way stops, capacity is a function of the number of lanes and the demand split among approaches, as shown in Tables 6.7 and 6.8 of the Highway Capacity Manual.⁹ Queue length at an intersection is computed from classical queueing theory; i.e., $Q_0 = 1/(\text{CAP}/\text{VOL}) - 1$. Average delay is a function of queue length times the time to process each vehicle.

SUBROUTINE PARKNG (EFFECTIVELY BYPASSED IN THE MODIFIED VERSION OF ISMAP)

This routine models parking zone flow and determines vehicle running time for a zone (see Figure 10 for flow chart). The running time of an average vehicle is considered to consist of three elements: (1) the time to travel from the edge of the zone to a stall or the time to travel from a stall to the edge of a zone (symbolized by TTA and TTD, respectively); (2) the delay experienced by arriving vehicles while waiting for vehicles to back out of stalls (DQ); (3) the average wait in a queue until a parked vehicle leaves the zone (AWQ).



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Figure 10. Parking model flow diagram.

TTA is computed on the basis of the length and speed of an average trip into the parking zone. It would appear that the length and speed of an average trip vary in direct and indirect proportion, respectively, to the utilization of a zone, and preliminary analysis of available data tends to support this supposition. TTD is the same as TTA, but with a time added to back out of a parking stall (PLBO).

DQ is the queued delay, due to interrupted flow lasting PLBO seconds, experienced by vehicles arriving in the parking zone. AWQ is a minimum value or is the time required to service each vehicle times an average queue length estimated from the utilization of the parking zone.

SUBROUTINE COORXY

To determine the location of steady speed, decelerating, queued, and accelerating vehicles on a link, it is necessary to know the direction of flow on the link (i.e., which end point traffic moves toward). This subroutine reorganizes the x,y coordinates of any link, L, so that X1(L), Y1(L) represent the upstream end of the link and X2(L), Y2(L) represent the downstream end of the link.

A second function of this routine is to convert the coordinates from feet to meters, since meters are the required units of distance in the dispersion submodel.

SUBROUTINE EMIT

Subroutine EMIT calculates the amount of CO produced on each traffic link (see Figure 4 for flow chart). The necessary input data come from the traffic analysis subroutine. These are: CAPL, COUNT, DIST, DQ, NLANE, NSTOPS, TT, and VEL. From this information, the model calculates the time and distance each vehicle devotes to constant velocity travel, deceleration, idling, and acceleration. The model then determines the amount of CO produced by one vehicle for 1 second for each cruise condition. Next, each of these emissions is assigned to that portion of the link where the emission occurred. The result is CO emissions as a function of position on each traffic link. The following are outputs of the EMIT subroutine for each traffic link: EMISS (I), I = 1,4 where I = 1 is the constant speed emissions, I = 2 is the decelerations emission, I = 3 is idling emissions, and I = 4 is the acceleration emissions, and DLINK (I), I = 1,4 is the distance over which each emission rate applies.

The emissions model also calculates parking zone emission rates based on total vehicle running time within the zone. Vehicles are assumed to emit CO within a zone at the idle emission rate, and the vehicle emissions are distributed evenly over an entire zone.

SUBROUTINE ACDC

The purpose of this subroutine is to calculate the total emission of CO by a vehicle accelerating from stop to a terminal velocity at a constant rate. Alternatively, the emissions generated by decelerating from a specific speed

to stop at a fixed rate can be determined. The integrated Model Emission equations were utilized to calculate the total CO emissions for the acceleration or deceleration mode.

SUBROUTINE CRUZ

This subroutine utilizes the Modal Emission Coefficients to calculate the CO emissions for vehicles traveling at a fixed rate of speed.

SUBROUTINE INITMM

This subroutine utilizes the composite vehicle age and mileage distribution calculated in SUP8 to calculate the vehicle distribution in the 20 modal model vehicle groupings. It also sets up the array of modal model coefficients.

SUBROUTINE SUP8

This subroutine calculates the average driving cycle emission factors and idle emission factors based on the parameters supplied to it. It, in turn, calls subroutines OUTPUT, EFCALX, BIGCFX, INITEX, TFCALX, SPFCLX, BEFGEN, GETCUM, EFALTX, CCEVAX, LDVIMX, ALUH, TRKOPC.

SUBROUTINE DISPER

This subroutine controls all dispersion calculations. It calls WIND, LSLOPE, STABLE, BASIC, GENGSC, and ZBORDR at the appropriate times (see Figure 11 for flow chart) and rounds off the coordinates of the link end points so that the center of a grid square cannot coincide with a link end point. As the final step before printing, DISPER divides the normalized CO concentrations by pi and the wind speed, converts the concentration to ppm, adds the background concentration, and multiplies by a factor that corrects the emission rate for the vehicle mix of 1971 to that of the input year and corrects for the ambient temperature and the fraction of hot and cold started vehicles.

SUBROUTINE WIND

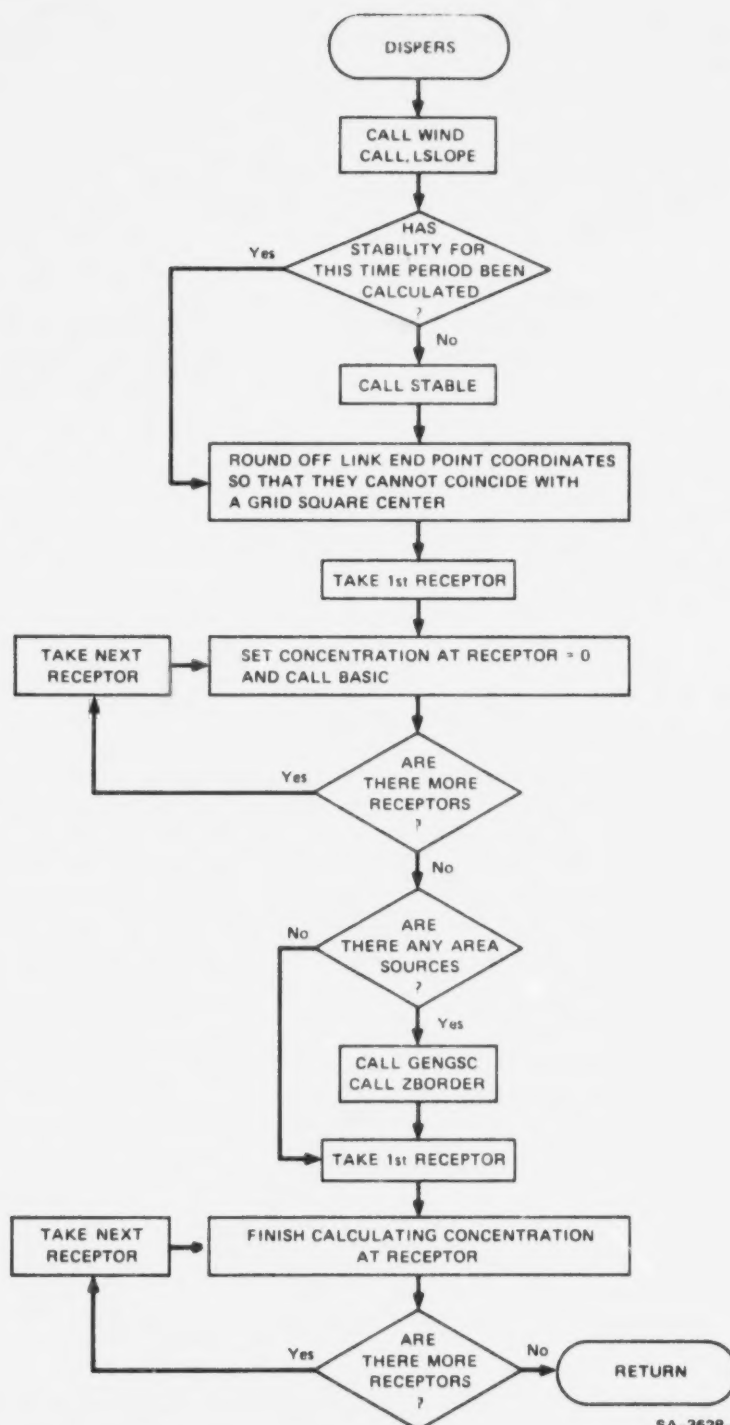
Meteorological wind direction, measured clockwise from north, is converted to algebraic wind direction, measured counterclockwise from east. In addition, the angle from the y axis to the wind vector is found by WIND.

SUBROUTINE LSLOPE

The slope and y intercept of each link are found by this subroutine. If the slope of a link is infinite, both the slope and the y intercept are set equal to zero as a cue to indicate that the link is vertical.

SUBROUTINE STABLE

STABLE determines the stability class and therefore the dispersion parameters for each hour of the day, unless stability is input directly. The



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Figure 11. Subroutine DISPERS flow diagram.

amount of cloud cover is used in determining an insolation class, which, when coupled with a wind speed class, allows an appropriate stability to be chosen from a table. If the user chooses to predetermine and read in stability as input, this initial part of the subroutine is bypassed, and the time period need not be 1 hour. Wind speed is converted from knots to meters per second for use in the point-source equation, and the diffusion parameters appropriate to the stability class are located from tables and stored.

SUBROUTINE BASIC

This routine determines whether all or any part of a link is upwind of a receptor. If a link lies within a 90° , pie-shaped segment that originates at the receptor and is bisected by the wind vector, the link is considered to be upwind of the receptor. The subroutine checks this by first transforming the coordinates of the link end points into a system with the origin at the receptor and the positive y axis in the direction from which the wind is blowing. If the new y coordinates of both end points of the link are negative, the link is downwind of the receptor. If the y coordinate of one or both end points of a link is positive and the angle between the new x axis and a line connecting a positive y coordinate of a link point with the origin is greater than or equal to 45° , at least part of the link is upwind of the receptor. It is also possible that the link passes through the segment even though neither of its end points lies in the pie-shaped segment. For this to occur the transformed x-coordinate of one end point must be positive and the other negative. In this case, the point at which the link intersects the y axis is found. If the y coordinate of that point is positive, the link passes through the segment and part of it is upwind of the receptor. If all or part of a link lies upwind of a receptor, BASIC calls ORIGIN, CORTRN, and CONCA1 or CONCA2.

In this routine the calculation was also performed to determine whether a street canyon vortex will form at each street canyon receptor location based upon hourly wind speed and stability conditions.

SUBROUTINE ORIGIN

Here the coordinates of the point to be the origin in a new coordinate system are found. For each link the origin is taken as the point of intersection of the link (or its extension) and the wind vector. ORIGIN also finds the angle from the wind vector to the link.

SUBROUTINE CORTRN

This subroutine transforms the coordinates of the receptor and the link end points into a new system with the y axis along the direction of the link and the origin as found by ORIGIN. This transformation is done so that the same Gaussian point source equation can apply to all receptor-link configurations.

SUBROUTINE CONCA1

CONCA1 is used when the wind is not parallel to the link. It calls MISC and XSIGN and computes the normalized CO concentration at a receptor resulting from each point on the link. Subroutine BASIC determined that at least part of the link is upwind of the receptor. Now each point on the link is checked to see that it is upwind of the receptor by comparing the sign of its distance along the wind direction to the receptor with the sign found by XSIGN. If the signs are the same, ISMAP determines what driving mode the traffic is in at the point on the link, chooses the corresponding emission rate, computes the lateral and vertical standard deviations of plume concentration, and applies the point source equation. Then for each receptor all point source concentrations are summed to give the CO concentration at the receptor from a link, and this concentration is added to the concentrations from other links for that receptor.

SUBROUTINE XSIGN

Some wind vector-link-receptor configurations are such that only part of a link is upwind of a receptor. In this case, there is a point on the link that has zero distance to the receptor along the wind direction. On one side of this point, the distance from link to receptor along the direction of the wind is positive; on the other side it is negative. Due to the coordinate transformation performed in CORTN, it is not known whether the points that are actually upwind will show positive or negative distances. Therefore, the sign of the distance along the wind direction from the receptor to a point known to be upwind of the receptor is found for use in determining which points on the link will contribute to the concentration.

The point used in the above determination depends on the orientation of the link and of the wind vector. When the wind vector and the link are not parallel, the coordinate system origin found by subroutine ORIGIN is used, unless it coincides with the receptor location. If it does coincide, the known point becomes the point of intersection of the wind vector passing through the receptor and the perpendicular to the wind that passes through a link end point. When the wind vector and the link are parallel and the receptor is located on an extension to the link, one of the link end points becomes the known point. Or, if the receptor is not located on an extension to the link, the known point used is the point of intersection of the wind vector passing through the receptor and the perpendicular to the link (or wind vector) that passes through a link end point.

When the quadrant from which the wind vector originates and the signs of the differences between the x coordinates and between the y coordinates in the original coordinate system of the receptor and the point chosen for the sign check are known, the sign of the distances from the receptor to those points that are upwind of the receptor can be determined. This sign is used in CONCA1 or CONCA2.

SUBROUTINE SPCING

This subroutine computes the distance to be taken between the point sources that represent the link, using the method presented in Section 2. Equation 12 is applied to determine the spacing. To compute the σ_y that appears in the equation, a downwind distance from point source to receptor is needed. If the wind vector that passes through the receptor (which is assumed to be perpendicular to the link) intersects the link, the downwind distance used in σ_y is simply the absolute value of the x coordinate of the receptor in the coordinate system generated by ORIGIN and CORTN. If the wind vector intersects an extension to the link, the distance from the receptor to the closest link end point is used for computation of σ_y . Then Equation 12 is solved for the spacing, letting the initial horizontal diffusion in the equation equal the spacing. However, if the value found for the spacing is less than 3 m, the assumed initial horizontal diffusion was less than 3 m. Since this assumption is probably not realistic, Equation 12 is solved again for the spacing, using 3 m as initial horizontal diffusion. To be conservative, the model uses half of the spacing value solved for as the distance between point sources. The spacing solved for above is taken as the value of initial horizontal diffusion on the link unless it is greater than the half-width of the link or less than 3 m. When the spacing value falls outside these limits, initial horizontal diffusion is set equal to the limiting value.

SUBROUTINE MISC

Several miscellaneous calculations are performed in this subroutine. MISC calls subroutine SPCING. It calculates the length of the link and the number of point sources that will represent the link. The subroutine finds the coordinates of the points on the link that separate one mode of driving operation from another. CONCA1 or CONCA2 uses these points to determine which driving mode is being practiced at the location of each point source on the link. MISC also initializes for each link the parameter on which concentrations are stored and the parameter that holds the y coordinate of the points that represent the link.

SUBROUTINE CONCA2

Subroutine CONCA2 is used when the wind is parallel to the link. It performs the same functions as CONCA1, except that the point source equation is formulated for the case where the link and wind vector are parallel.

SUBROUTINE GENGSC

The emissions from each area source are assumed to be uniform over the area source. Therefore, ISMAP overlays a grid on the entire region being modeled and allocates the emissions of an area source equally to those grid squares that cover the source. The emissions from a grid square are assumed to be released from the center of the square. Subroutine GENGSC finds the maximum of both the x and y coordinates of all link end points to determine the area over which the grid will be overlayed. The number of grid squares in both the x and y directions are determined using the maximum found above

and the grid size that was input. Then, to conserve space in core memory, the coordinates of the centers of the grid squares are generated separately, to be paired later in ISMAP. The final step in the subroutine is to set the initial diffusion for area sources equal to the grid size.

SUBROUTINE ZBORDR

A zone (i.e., area source) may have up to six border links that form its sides. A zone may also have one nonlink side, but the border link information must be input such that the first and last border links are the links that do not connect. For each zone subroutine ZBORDR checks to see that one of the end points of a border link connects with an end point of the next link. If the specified border links do not connect, an error message is printed and computations for the zone are bypassed. If the links do connect, subroutine INTERS is called. This checking procedure and calling of INTERS continues until all the border links have been exhausted. If the open end points of the first and last links connect, the program calls subroutine ZNGSC; if the open ends do not connect, the last side of the zone, along with its slope and y intercept, are generated and ZNGSC is called. The entire procedure outlined above is repeated for each zone.

Other subroutines, called by ZNGSC, compute the contribution to the CO concentration at a receptor from each zone. After the routines have been called, ZBORDR multiplies the concentration contribution of each zone for each receptor by the zone emission rate and divides by the number of grid squares in the zone. These concentrations then are summed for each receptor. However, the results are still normalized by π and the wind speed. In the modified version of ISMAP, the interior zones will be bordered by only two links.

SUBROUTINE INTERS

Since the overlay grid is made up of regularly spaced squares, the centers of the squares can be said to lie in vertical lines. There are as many of these lines as there are grid squares in the x direction. This subroutine finds points of intersection of each vertical line with the sides of a zone. Since the manner in which the grid square centers were generated and the manner by which the link end points were rounded off preclude the possibility of a vertical line passing through a zone border link end point, there will be an even number of points of intersection on each vertical line. The points of intersection are found for one zone at a time, and the number of points of intersection on each vertical line, as well as the y coordinate of each point of intersection, are stored. The x coordinates can be found from the index of the vertical line since the values are the same as those of the x coordinates of the grid square centers with the same index.

SUBROUTINE ZNGSC

The y coordinates of the points of intersection of a vertical line with the zone sides, found by INTERS, will not be necessarily in ascending or

descending numerical order. Subroutine ZNGSC places the intersection points on each vertical line in descending numerical order so that they may be paired. If an uneven number of points of intersection are found, an error message is printed and further computations for the zone are bypassed. Otherwise, each grid square center that lies on a vertical line is checked to see if it lies between any of the pairs of intersection points. If it does, the grid square center, and therefore the grid square, lies within the zone. When a grid square center is found to be located in a zone, it is counted, subroutine ZCHECK is called, and the x and y coordinates of the grid square center are passed to ZCHECK.

SUBROUTINE ZCHECK

This subroutine transforms the coordinates of a zone grid square center into a system with the origin at a receptor and the y axis along the direction of the wind. If the transformed y coordinate of the grid square center is negative, the grid center is downwind of the receptor. For a positive y coordinate, if the angle that a line passing through the origin and the grid center makes with the x axis is less than 45° , the grid center is assumed to be positioned such that its contribution to the concentration at the receptor is negligible. If the angle is greater than or equal to 45° , subroutine CONCA3 is called. The above procedure is repeated for all receptors.

SUBROUTINE CONCA3

The transformed y coordinate of the grid square center that was passed along from ZCHECK is the distance along the direction of the wind from the point source to the receptor. This distance and the diffusion parameters found in STABLE are used to calculate the lateral and vertical standard deviations of plume concentration. The x coordinate of the grid square center gives the crosswind distance from source to receptor. Using these values, CONCA3 calculates a normalized concentration at a receptor resulting from a grid square of a zone. This concentration is added to the contributions to the concentration at the receptor from other grid squares in the zone. The results of CONCA3 are passed back to ZBORDR.

SUBROUTINE STREET

If the calculation in subroutine BASIC indicates, based upon hourly wind speeds and atmospheric stabilities, that a street canyon vortex will form at a particular street canyon receptor location, then subroutine STREET will be called to calculate the hourly concentration contribution from the street canyon links, which will then be added to the remaining link contributions calculated by the line source dispersion model. The calculated street canyon concentration will depend upon whether the receptor is located on the windward or leeward side of the street.

SECTION 4

INPUT DATA SPECIFICATION

The first step in the preparation of input data for the modified version of ISMAP is to draw a map of the traffic network under study. The link end-points and receptor locations must be specified by coordinates in a west to east (x) and south to north (y) coordinate system. Each link must be characterized by the number of lanes and the identification numbers for those links branching from (turning left, turning right and going straight) the link in question. For each intersection the signal type (if signalized) and phase times must be specified. Receptor locations that are potential street canyons must be so identified. For such receptors, the user must also specify the direction of the street with respect to north, the identification numbers of the links comprising the street, the width of the street (building to building) and the height of the buildings on the street.

The most critical inputs to the modified ISMAP are the assignment of the internal and external zones in terms of the links entering and leaving the zone and the number of vehicles attracted to or generated by the internal zones during a given hour. Vehicle trips from an external zone are directed toward internal zones based upon the trip attraction of the internal zones. In the same manner, vehicle trips generated by internal zones are apportioned to external zones, but trips cannot be generated between individual internal or external zones. Since parking lots are not considered in the modified version of ISMAP, the internal and external zones are physically indistinguishable, with each consisting of an entrance and exit link pair. As illustrated by our sample model application presented in Section 5, the names "internal" or "external" zones do not indicate the geographic location of these zones but only signify that vehicles are routed between these two types of zones.

The final input requirement for the model is the hourly meteorological data for use in the dispersion calculation. Hourly temperature is also input for calculation of cold and hot start vehicle emission correction factors.

In Table 2 the program input requirements are listed on a card by card basis along with column numbers, format specification, units, value limits and general description. The remainder of this section will be devoted to a detailed description of each input card.

TABLE 2. MODIFIED ISMAP BASIC INPUT INFORMATION CARDS 0 THROUGH 10
(Data Read in by Subroutine INPT)

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
0 Header	1-6	I6	NYEAR	-	710101 to 991231	741004	Date in year, month, day sequence Heading to precede output summary
	7-76	18A4	LHEAD	-	-	EXAMPLE CASE	
	80	I1	NO PARK	-	1		Must be set equal to 1
1	1-2	I2	IC	-	-	-	Card type number
	3-5	I3	L	-	0* to 200	154 (previously stored value)	Number of cards of type 2
	6-10	I5	1	-	0* to 70	48 (previously stored value)	Number of cards of type 3
	11-15	I5	2	-	0* to 50	25 (previously stored value)	Number of cards of type 4
	16-20	I5	ICN	-	0 or 1	1 (previously stored value)	Number of cards of type 5
	21-25	I5	IG	-	0* to 10	7 (previously stored value)	Number of cards of type 6
	26-30	I5	NV	-	0* to 3	3 (previously stored value)	Number of cards of type 7
	31-35	I5	KT	-	0 to 200	15 (previously stored value)	Number of cards of type 8
	36-40	I5	NR	-	0* to 200	26 (previously stored value)	Number of cards of type 9
	41-45	I5	NMET	-	0* to 24	1 (previously stored value)	Number of cards of type 10
	46-50	F5.0	TOD	hours	0 to 23	8	Hour of day
	51-55	F5.0	DOM	-	1 to 7	3	Day of week (Sun. = 1, Mon. = 2 . . . Sat. = 7)
	56-60	F5.0	TP	sec	900 to 7200	3600	Time period duration
	61-65	F5.0	TOTATT	vehicles	≥ 0	124	Total trips attracted to and generated by the indirect sources during time period specified
	66-70	F5.0	TOTGEN	vehicles	≥ 0	74	
	71-75	F5.0	PD	ft ² /veh	360	360	Parking density constant (number of ft ² required to park each vehicle)
	76-80	I5	ITM	-	1 to 10	2 (1)	Number of iterations of the route selection process

May not be 0 on first iteration of program.

(continued)

TABLE 2 (continued).

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
2	1-2	I2	I0	-	2	2	Card type number
	3-5	I3	L	-	0 to 200	1	Link number
	6-10	I5	NLANE(L)	-	> 1	2	Number of lanes
	11-15	F5.0	X1(L)	ft	> 0	3751	x-coordinate of northernmost end point (easternmost coordinate if link runs E-W)
	16-20	F5.0	Y1(L)	ft	> 0	2363	y-coordinate of northernmost end point
	21-25	F5.0	X2(L)	ft	> 0	2247	x-coordinate of southernmost end point
	26-30	F5.0	Y2(L)	ft	> 0	2673	y-coordinate of southernmost end point (links should terminate at the in- tersection center)
	31-35	I5	LCAP(L)	veh/hr	> 1	-0 (1800)	Capacity of link, veh/hr
	36-40	F5.0	VEL(L)	ft/sec	1 to 147	58	Speed, ft/sec
	41-45	I5	LCON(L,1)	-	0 to 200	3	Link to link connections. The link that L connects to going straight
	46-50	I5	LCON(L,2)	-	0 to 200	26	The link L connects to going right
	51-55	I5	LCON(L,3)	-	0 to 200	27	The link that L connects to going left
	56-60	F5.0	HEIGHT(L)	ft	> 0	0	Emission height

(continued)

TABLE 2 (continued).

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
3	1-2	I2	IC	-	3	3	Card type number
	2-5	I3	I	-	0 to 70	1	Intersection number
	6-10	I5	LIN(1,J)	-	0 to 200	142	North link number
	11-15	I5	LIN(1,J)	-	3 to 200	4	East link number
	16-20	I5	LIN(1,J)	-	0 to 200	143	South link number
	21-25	I5	LIN(1,J)	-	0 to 200	1	West link number
	26-30	I5	ITVPC(I)	-	-2 to 5	2	Type control; -1 = 2 way stop; -2 = 4 way stop; 0 = no control; 2,3 = V/A control; 1 = fixed time control; 4 = type 2 N-S, type 3 E-W; 5 = type 3 N-S, type 2 E-W
							Type I Type II Type III ft actuated phases phases phases
31-35	I5	CYCL(I)		sec	$\geq$ PH(1,J)	200	Cycle Max cycle
36-39	F4,0	PH(1,J)		sec	$\geq$ 0	10	Min N-S
40-43	F4,0	PH(1,J)		sec	$\geq$ 0	10	Min E-W
44-47	F4,0	PH(1,J)		sec	$\geq$ 0	0	Min N-S LT
48-51	F4,0	PH(1,J)		sec	$\geq$ 0	0	Min E-W LT
52-55	F4,0	CI(I)		sec	$\geq$ 0	3	Yellow time interval
56-59	F4,0	GCAP(1,1)		veh/hr	$\geq$ 0	3600 (1200 veh/ hr/lane)	Capacity of one approach N (or S) for phase 1 per hr green
60-63	F4,0	GCAP(1,2)		veh/hr	$\geq$ 0	4000 (1200 veh/ hr/lane)	Capacity of E (or W) phase 2 per hr green
64-67	F4,0	GCAP(1,3)		veh/hr	$\geq$ 0	0 (1200 veh/hr/ lane)	Capacity of S or S-N phase 3 per hr green
68-71	F4,0	GCAP(1,4)		veh/hr	$\geq$ 0	0 (1200 veh/hr/ lane)	Capacity of W or W-E phase 4 per hr green

(continued)

TABLE 2 (continued).

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
4	1-2	I2	IC	-	4	4	Card type number
3-4	A2	A2	TEXT	-	01 - 99	5	Zone identification (interior zones: 01-50; exterior zones: 51-99)
5-7	F3.0	F3.0	ZATTR(2)	veh/hr or %	≥ 0	2	Zone attractions in either (1) average volume (veh/hr) or (2) % of total trips attracted to all interior or all exterior zones
8-10	F3.0	F3.0	ZGENR(2)	veh/hr or %	≥ 0	2	Zone generations in either (1) average volume (veh/hr) or (2) % of total trips generated to all the interior or to the exterior zones
11-13	F3.1	F3.1	ZVT(1,2)	-	≥ 0	0, (1.)	Fraction of zone attractions and genera- tions that are automobiles
14-16	F3.1	F3.1	ZVT(2,2)	-	≥ 0	0.	Fraction of zone attractions and genera- tions that are buses
17-19	F3.1	F3.1	ZVT(3,2)	-	≥ 0	0.	Fraction of zone attractions and genera- tions that are other vehicle types
20-24	F5.0	F5.0	FVPH	veh	≥ 0	0	Initial number of parked vehicles in zone
25-29	F5.0	F5.0	PLC	veh or gm/ sec	≥ 0	0	Parking lot capacity in vehicles (if left blank lot capacity is generated by the computer) or zone emissions for exterior zones in gm/s during time period
30-31	I2	I2	NZL	-	1 to 6	1	Number of sides (links) which define park- ing area (the first NZL bordering links define the parking lot area)
32-35	I4	I4	ZLINKS(1,2)	-	0 to 200	112	Bordering link number 1 (a negative link number indicates no access to the zone from this link)
36-39	I4	I4	ZLINKS(2,2)	-	0 to 200	111	Bordering link number 2
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
76-79	I4	I4	ZLINKS(12,2)	-	0 to 200	0	Bordering link number 12

(continued)

TABLE 2 (continued).

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
5	1-2	12	IC	-	5	5	Card type number
3-6	F4.0	F4.0	GRDSIZE	m	≥ 0.	10. (10.)	Grid size
7-10	F4.0	F4.0	BACKGRD	ppm	≥ 0.	0.	Background concentration at site
11-14	F4.0	F4.0	SLAT	deg of lat.	0. to 90.	0.	Latitude of site (needed only if stability is to be computed by ISMAP)
15-18	F4.0	F4.0	TUNFAC	-	0.1 to 3.	1.	Tuning factor
19-22	F4.0	F4.0	ZCONST	m	3. to 10.	10. (3.)	Initial vertical diffusion
23-24	12	12	IREG	-	1,2,3	1	Region: 1 = low 2 = calif., 3 = high
25-28	F4.0	F4.0	TEMP	°F	0 - 110	75.	Temperature
29-33	F5.3	F5.3	COLD	-	0 - 1	0.20	Proportion of cold starts
34-38	F5.3	F5.3	HOT	-	0 - 1	0.20	Proportion of hot starts
39-43	F5.3	F5.3	CCOLD	-	0 - 1	0.20	Proportion of catalyst cold starts
44-48	F5.3	F5.3	WMTMX(1)	-	0. to 1.	0.75	Fraction of light-duty vehicles
49-53	F5.3	F5.3	WMTMX(2)	-	0. to 1.	0.05	Fraction of light-duty trucks, less than 6000 GW
54-58	F5.3	F5.3	WMTMX(3)	-	0. to 1.	0.05	Fraction of light-duty trucks, 6000 - 8500 GW
59-63	F5.3	F5.3	WMTMX(4)	-	0. to 1.	0.09	Fraction of heavy-duty gasoline-fueled vehicles
64-68	F5.3	F5.3	WMTMX(5)	-	0. to 1.	0.06	Fraction of heavy-duty diesel-fueled vehicles
69-73	F5.3	F5.3	WMTMX(6)	-	0. to 1.	0.005	Fraction of motorcycles
74-75	12	12	ALHFLG	-	0 or 1	0	Flag for optional air conditioning, loading humidity correction
76	11	11	TRKFLG	-	0 or 1	0	Flag for optional truck correction
77	11	11	IMPLG	-	0 or 1	0	Flag for optional I/M correction

(continued)

TABLE 2 (continued).

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
Omit if ALHFLG equals zero							
5A	1-10	-	-	-	-	-	Blank
	11-20	F10.0	AC	-	-	.30	Fraction of LDV and LDT VMT with air-conditioning
	21-30	F10.0	XLOAD(1)	-	-	.10	Fraction of LDV VMT with additional 500 lb load
	31-40	F10.0	XLOAD(2)	-	-	.10	Fraction of LDT1 VMT with additional 500 lb load
	41-50	F10.0	XLOAD(3)	-	-	.10	Fraction of LDT2 VMT with additional 500 lb load
	51-60	F10.0	TRAILR	-	-	.05	Fraction of LDV VMT with a trailer (1,000 pounds)
	61-70	F10.0	ABSHUM	gr/lb	-	75	Humidity (not currently applicable)
Omit if TRKFLG equals zero							
5B	1-10	-	-	-	-	-	Blank
	11-20	F10.0	HGMGT	lbs	-	18,000	Average gas vehicle weight
	21-30	F10.0	HDMGT	lbs	19,000-55,000	45,000	Average diesel vehicle weight
	31-40	F10.0	HGCCID	in ³	330-390	350	Average gas displacement
	41-50	F10.0	HDCID	in ³	540-600	580	Average diesel displacement
Omit if IMPLG equals zero							
5C	1-10	-	-	-	-	-	Blank
	11-15	I5	ICYM	-	-	82	Last two digits of implementation year of 1/M
	16-20	I5	ISTRIN	-	-	30	Stringency
	21-25	I5	IMPLG	-	0-1	0	Mechanic's training (1 = yes)
	26-30	I5	MODYR1	-	-	71	Beginning and ending model
	31-35	I5	MODYR2	-	-	81	years subject to inspection
6	1-2	I2	IC	-	6	6	Card type number
	6-10	I5	LGATE(1,IC)	-	1 to 200	15	Link number of exit gate to parking lot
	11-15	I5	LGATE(2,IC)	-	1 to 200	16	Link number of approach to parking lot

(continued)

TABLE 2 (continued).

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
7	1-2	I2	IC	-	7	7	Card type number
	3-5	I3	VT	-	1, 2, or 3	1	Vehicle type, auto (park) = 1; bus (stop and load) = 2; truck (stop and wait) = 3
	6-10	F5.3	VTP(VT)	-	≥ 1 .	1.4	Number of passengers in average vehicle
	11-15	F5.3	VTE(VT)	-			

(continued)

TABLE 2 (continued).

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
8	1-2	I2	IC	-	8	8	Card type number
	3-5	I3	?	-	1 to 200	151	Link number on which count occurs ($1 \leq L \leq NLINK$)
	6-10	F5.0	COUNT(1,L)	veh	≥ 0	755.	Count going straight from link 1 through the intersection during time period
	11-15	F5.0	COUNT(2,L)	veh	≥ 0	88.	Count going right from link 1
	16-20	F5.0	COUNT(3,L)	veh	≥ 0	107.	Count going left from link 1
	21-25	I5	L2	-	1 to 200	152	Link number on which count occurs
	26-30	F5.0	COUNT(1,L2)	veh	≥ 0	1064.	Count going straight from link L2
	31-35	F5.0	COUNT(2,L2)	veh	≥ 0	0.	Count going right from link L2
	36-40	F5.0	COUNT(3,L2)	veh	≥ 0	0.	Count going left from link L2
	41-45	I5	L3	-	1 to 200	153	Link number on which count occurs
	46-50	F5.0	COUNT(1,L3)	veh	≥ 0	457.	Count going straight from link L3
	51-55	F5.0	COUNT(2,L3)	veh	≥ 0	147.	Count going right from link L3
	56-60	F5.0	COUNT(3,L3)	veh	≥ 0	170.	Count going left from link L3
	61-65	I5	L4	-	1 to 200	154	Link number on which count occurs
	66-70	F5.0	COUNT(1,L4)	veh	≥ 0	429.	Count going straight from link L4
	71-75	F5.0	COUNT(2,L4)	veh	≥ 0	0.	Count going right from link L4
	76-80	F5.0	COUNT(3,L4)	veh	≥ 0	0.	Count going left from link L4

(continued)

TABLE 2 (continued).

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
9	1-2	I2	IC	-	9	9	Card type number
3-12	F10.5	XO(1)		ft	> 0.	2983.75	X-coordinate of receptor location
13-22	F10.5	YO(1)		ft	> 0.	3774.25	Y-coordinate of receptor location
23-25	I3	ISTR(I)		-	0, 1	0	0 = exclude street canyon model 1 = potential street canyon receptor
26-30	F5.0	AST(I)		deg from N	0. to 180.	17.0	Direction of the street in degrees from north
31-35	I5	NLKST(I)		-	0 to 2	2	Number of links influencing the street canyon receptor
36-45	F10.0	WST(I)		ft	> 0	60.	Receptor street width
46-55	F10.0	BUILDH(I)		ft	> 0	70.	Building height
56-60	F5.0	RECHT(I)		ft	> 0	5.	Receptor height
61-66	I13	ISTLIN(I,J), J = 1, 2			≥ 0	1, 2	Identification numbers for those links affecting receptor I
67-70	I4	IRSIDE(I)			1 or 2	1	Side of the street on which receptor I is located with respect to the street heading specified by AST(I) (1 = right, 2 = left)

(continued)

TABLE 2 (continued).

Card	Column	Format	Symbol	Units	Value limits	Typical value (default value in parentheses)	Description
10	1-2	I2	IC	-	10	10	Card type number
	3-10	F8.2	THETA(I)	deg from N	0. to 360.	101.	Wind direction
	11-18	F8.2	WS(I)	knots	≥ 1.94	3.89	Wind speed
	19-23	I5	ISTAB(I)	-	1 to 5	4	Stability class
	or		or				or
	19-23	I5	ICLD(I)	tenths	0 to 10	-	Cloud cover

HEADER CARD (CARD TYPE 0)

The first data card for each time period is a header card containing the date and a descriptor that identifies the run. The descriptor may consist of any 70 alphanumeric characters. Column 80 must contain a 1 for the modified version of ISMAP to be run correctly.

RUN DESCRIPTION (CARD TYPE 1)

For each time period the header card is followed by card type 1. This card denotes how many of each of the other card types (2 through 10) should be read for that time period. If the data on a card type does not change from one time period to the next, the card type 1 for the second time period should have a zero or spaces in the proper columns to indicate that the data have not changed and no new cards of a particular type should be read.

Card type 1 also contains the time of day, TOD, and the day of week, DOW. The input value for time of day should be the beginning of the period being simulated; e.g., when computing hourly concentrations, TOD is 8 for the period 0800 to 0900 LST. For day of week, 1 is Sunday, 2 is Monday, and so forth. The length of time being simulated with each iteration of ISMAP is specified as TP. This value can be meaningfully varied from 900 sec (15 minutes) to 7200 sec (2 hours). In general, traffic counts and demands and meteorological data are available as 1-hour summaries; for this reason the usual value for TP is 3600. The trips attracted to and generated by the interior zones during a time period of duration TP are read as TOTATT and TOTGEN. The input value for the parking density constant is ignored by the modified version of ISMAP. This variable is set equal to an extremely low value to avoid routing of vehicles between interior zones.

The number of iterations of the route selection process may be input using the ITM parameter. The default value for ITM is 1, which means that one iteration of the route selection process will be made in which four alternative routes will be selected between each external-internal and internal-external zone pair. Vehicles are routed onto these alternative routes based on travel time and gate capacity. When ITM is 2, the route selection process is carried out twice and half of the vehicles to be routed are applied to the four initially selected alternative routes, and half the vehicles are applied to the second four alternative routes. When ITM is greater than 1, vehicles can be routed around intersections that are predicted to be congested by earlier route selection iterations. A computer run time increase of about 60 percent can be expected when specifying ITM = 2 rather than ITM = 1, when only one receptor location (card type 9) has been specified.

LINK DESCRIPTION (CARD TYPE 2)

Each direction of flow on a street within the network is assigned a link number. A card type 2 is read for each link and includes the link number. The average number of lanes of traffic that make up the link are specified, and link capacity is determined when such capacity is not input (at 1200 veh/lane for speeds less than 70 ft/sec and 1800 veh/lane for speeds greater than 70 ft/sec).

Coordinates must be read that specify each link's end points in the horizontal plane. There are dire consequences if zones are defined by links that do not connect at their end points (see card type 4 description). Coordinates are input in feet from some arbitrary origin and must be positive.

Link capacity may be input or left to be computed by ISMAP. Usually a network is very insensitive to link capacity, intersection capacity being the controlling variable. The exception is a freeway or other limited access road, which might be included in the simulated network.

Speed, in ft/sec, on a link indicates the average speed that vehicles travel during low-use periods. This can usually be estimated as the speed limit on the link.

Link-to-link connections are specified for each link going straight, right, and left. When a link does not lead to another link, the connection should be input as zero or spaces.

An emission height must be input for elevated links. When modeling a facility located on relatively flat terrain, an emission height of zero is normally input for all traffic links. While a more realistic value of the emission height would be 0.5 m, this change would cause little effect upon the calculated concentration if an initial vertical diffusion of 3 m were specified. At present, depressed roadways are treated as surface emission sources, while roadways upwind of aerodynamic barriers may be assigned effective emission heights, as necessary.

INTERSECTION DESCRIPTION (CARD TYPE 3)

An intersection description is required for each intersection in the network. An intersection can be defined at each connection between two or more links. The link numbers of streets entering the intersection from the north, east, south, and west are input parameters. If there is no link approaching from some cardinal direction, spaces or zeros should be entered.

A type of control for each intersection (I) must be specified as follows:

- | | |
|---------------|---|
| ITYPC(I) = -2 | indicates a 4-way arterial stop. |
| ITYPC(I) = -1 | indicates a 2-way arterial stop. The approach with the largest volume is considered to be uncontrolled, while the cross traffic links are assumed to have stop signs. |
| ITYPC(I) = 0 | indicates no control on any approach. |
| ITYPC(I) = 1 | indicates a fixed time signal controller. |

- ITYPC(I) = 2 indicates a vehicle-actuated (VA) controller with possible separate left turning phases for north-south and east-west traffic.
- ITYPC(I) = 3 indicates a vehicle-actuated controller with each intersection approach controlled by a separate signal phase. During a green phase, left-turning vehicles do not have to cross an opposing traffic flow since the opposing traffic experiences a red signal.
- ITYPC(I) = 4 indicates type 2 control on the north-south approaches and type 3 control on the east-west approaches. The north-south approaches are controlled by a vehicle-actuated controller during phase 1 of the signal cycle. If phase 3 is specified as having other than zero phase length, left turns from the north-south directions are made during phase 3. If phase 3 is specified as having a zero phase length, then left-turning vehicles are assumed to move during phase 1 and experience opposing vehicular flow. Phases 2 and 4 are exclusive green phases for the east and west approaches, respectively.
- ITYPC(I) = 5 indicates type 3 control on the north-south approaches and type 2 control on the east-west approaches. Phases 1 and 3 are exclusive green phases controlling the north and south approaches, respectively. The east-west approaches are controlled by a vehicle-actuated controller during phase 2 of the signal cycle. If phase 4 is specified as having other than zero phase length, left turns from the east-west directions are made during this phase. If phase 4 is specified as having a zero phase length, left-turning vehicles are assumed to move during phase 2 and to experience opposing vehicular flow.

The five controller types are intended to allow any fixed time or VA type control to be simulated. The controllers are simplified, however, and cannot be used to exactly replicate leading or lagging left-turn phases, or 8-phase-full-quad-left signal controllers. It is often possible to adjust the capacity of an intersection to compensate for the lack of a more sophisticated simulated signal controller, and produce meaningful results. An 8-phase-quad-left control is best simulated by a type 2 controller.

Each signal controller must have a maximum cycle length specified, as well as nonzero phase times for each operating signal phase. For example, a simple fixed-time signal might have a 60-sec cycle time and 30-sec north-south and 30-sec east-west phase lengths. If phase 3 and phase 4 times are set to zero, the ISMAP simulation assumes left turns are made through opposing

traffic during phases 1 and 2. When specifying VA control, each phase time represents a minimum phase length. Green time is apportioned among the phases in proportion to the largest demand capacity ratio on the controlled approaches. For example, a type 2 controlled intersection might have a maximum cycle length of 240 sec, minimum north-south phase 1 and east-west phase 2 green times of 30 sec, and minimum north-south left-turn phase 3 and east-west left-turn phase 4 green times of 10 sec. This signal could operate at an 80-sec cycle time under low demand conditions (30+30+10+10) and at a 240-sec cycle time under high demand conditions. (Actually, if there is no demand for the east-west left-turn phase 4, phase skippability will be assumed and a 70-sec minimum cycle time would be possible.)

A yellow clearance interval, CI(I), is specified for each controller. This interval is applied to each phase of each controller and decreases the effective green time of each signal phase by $CI(I)/2$.

Four approach capacities may be specified, one for each approach (or phase if the intersection is signalized). If an input capacity parameter is left blank, ISMAP will determine a capacity based on the number of lanes on the approach link and the type of intersection control. Capacity of a signalized intersection approach can be determined by selecting the capacity per hour of green based on the road width from Figures 6.6 through 6.13 in the Highway Capacity Manual.⁹ The capacity so selected assumes 10 percent left-turning and 10 percent right-turning vehicles. ISMAP adjusts the input capacity based on the percentage of vehicles actually routed left and right in the modeled network. When a 3 or 4 phase and type 1 or 2 signal is specified, the 3rd phase is assumed to be the north-south left-turn phase and the 4th phase is assumed to be the east-west left-turn phase. The capacities input should be the maximum of the left-turning approaches during the 3rd or 4th phase. A type 3 intersection assumes the 3rd and 4th phases control the south and east approaches and the 3rd and 4th capacities are the capacities of these approaches.

Besides an adjustment for number of turning vehicles, ISMAP assumes there is a left-turn lane where left-turn phases are specified. This has the effect of increasing capacity to the through vehicles, as well as to the left-turning vehicles.

ZONE DESCRIPTION (CARD TYPE 4)

Vehicle routing takes place from exterior zones to interior zones with the facility and vice versa. In the original ISMAP interior zones were parking zones surrounded by links of the network. Exterior zones are usually assigned to each exterior street from which vehicles enter or leave the network. Interior zones are identified by numbers 01 to 50 while exterior zones are numbered 51 to 99.

Each zone identified will have an attraction factor (ZATTR) and a generation factor (ZGENR) assigned to it by the user. These factors may vary from hour to hour (as would be the case for an office building parking lot located within a shopping center) or may remain constant throughout the day. The

factors may be in units of percent of TOTATT and TOTGEN (input on card type 1) or in units of vehicles attracted and generated by the zone during a time period, but the units must be consistent on all zone cards. The factors are summarized within ISMAP for all exterior and all interior zones, and a percentage of the total is determined for each zone and is multiplied by TOTATT and TOTGEN to determine the vehicles attracted or generated. TOTATT is the number of trips attracted to a facility from exterior zones. Therefore, each ZATTR specified for an interior zone will represent a part of TOTATT, while each ZATTR specified for an exterior zone will represent a part of TOTGEN.

Vehicle trips to a zone may be in terms of autos, buses, and trucks. Autos are the only vehicles that will use parking capacity. The percent of each type of trip to each zone is an input parameter.

When a run is initialized on the computer, zero cars are assumed to be parked in each zone unless a parked vehicle value is input. Since the number of parked vehicles is saved from iteration to iteration, it is unnecessary to input parked vehicle values except on the first iteration of ISMAP.

A parking zone capacity (PLC) is input in a number of vehicles. This parameter, if left blank, will be calculated by ISMAP based on the parking zone area. It is important to input PLC when a building or other facility is present within the parking zone.

The number of sides that define each parking zone (NZL) must be input for each interior zone. A parking zone is defined as a polygon of no more than six sides. The links that surround the zone should be input (as ZLINKS) in an order such that each link immediately follows the link to which it is connected. When defining a zone, if the last link does not connect with the first link, the program will construct a side to close the zone. The constructed side should not be included in NZL. For the modified ISMAP, NZL must be input as 2 or less, and the links surrounding the zone, ZLINKS, must be identified as the two links entering and leaving the internal zone.

LOCAL AREA DESCRIPTION (CARD TYPE 5)

Local area descriptors appear on card type 5. The user must input the percentage of heavy duty vehicles in the total traffic, the altitude and latitude of the site, and the background CO concentrations at the site. The size of the grid into which area source emissions will be parceled also must be specified. This input parameter depends somewhat on the size of the area to be modeled. Grid sizes of 5 to 10 m are deemed appropriate for applications such as shopping centers. An input value that is too small will result in the generation of arrays requiring more computer storage than has been set aside. To determine the minimum grid size allowed, divide the maximum value of the link end point coordinates by 298.001. It should be noted that computer running costs will increase nonlinearly as the grid size decreases. A default value of 10 m will be used for the grid size if 0 is input. A tuning factor is input on this card, which can be used to adjust modeled emissions, based on measured emissions, or to adjust emissions based on different emission factors found in other countries.

Card type 5 also requires specification of a distance representing initial vertical diffusion. Suggested values for this parameter are in the range of 3 to 10 m. If a value less than 3 m is input, ISMAP will set the constant equal to 3 m.

Also input on this card are the region, temperature, cold and hot starts, and the fractions of the vehicle population of light-duty vehicles, light-duty trucks, heavy-duty gasoline fueled vehicles, heavy-duty diesel-fueled vehicles and motorcycles. The final input variables on this card are indicators of whether the supplemental correction factors are to be used. (These factors are identical to MOBILE1.) If used cards 5A, 5B and/or 5C must be supplied.)

GATE DESCRIPTION (CARD TYPE 6)

Each entrance and exit gate to an internal zone must be specified by a gate description card. Two links define a gate: one is the link by which vehicles leave the center, and the second is the link by which vehicles enter the center. The capacity for each gate is determined by the program based on input or assumed link capacities. Recall that vehicles are allocated to four alternate routes in inverse proportion to travel time and volume to capacity ration of the gate used. Thus, all trips between external and internal zones must be routed through a gate. If a route exists between an external and internal zone that does not go through a gate, the program will fail without any explanation.

VEHICLE CHARACTERISTICS (CARD TYPE 7)

This card is read for each type of vehicle entering the facility. The three possible types of vehicles are autos, buses, and trucks. Each vehicle should have a load factor associated with it, indicating the number of person trips to the facility that are associated with each vehicle.

VEHICLE COUNTS (CARD TYPE 8)

The purpose of this card is to specify the nonfacility vehicles that use the street network. The links and intersections outside the facility will handle vehicle trips to the facility as well as other trips. The Vehicle Count cards are used to apply the nonfacility-oriented trips to the street network. The counts for as many as four links can be included on each card. The count on a link is broken down into vehicles traveling straight, turning right, or turning left at the downstream intersection of the link with other links. It is convenient to include the counts of four approaches to an intersection on a card. The input parameters are:

- North approach link number (L) followed by the counts on this approach traveling straight, right, and left.
- East approach link number (L2) followed by the counts on this approach traveling straight, right, and left.
- South approach link number (L3) followed by the counts on this approach traveling straight, right, and left.

- West approach link number (L4) followed by the counts on this approach traveling straight, right, and left.

The facility-oriented vehicles are added to the Vehicle Counts during an ISMAP run to determine the total vehicles on each link of the network.

RECEPTOR DESCRIPTION (CARD TYPE 9)

The x- and y-coordinates of each receptor location are input on card type 9. The values for these coordinates are in feet and must be positive and based on the same origin used for link coordinates. If the receptor is located in a potential street canyon the user must also specify the relevant street canyon characteristics discussed earlier in this section.

METEOROLOGICAL VARIABLES (CARD TYPE 10)

Card type 10 contains the meteorological information necessary for dispersion calculations. The user has the option of specifying the stability class as input or allowing ISMAP to calculate stability class from cloud cover and wind speed data. However, the stability determination capability of ISMAP can only be used when the time period being simulated is 1 hour. If stability is to be input, one card type 10, with values for wind direction, wind speed, and stability class, is input with traffic and site descriptors for each time period (durations of from 900 to 7200 sec are possible). If ISMAP is to calculate stability class, 24 card type 10s containing observations of wind direction, wind speed, and cloud cover for 24 hours of the day are input with the traffic and site data for the first hour for which CO concentrations are to be computed. If stability is to be found by ISMAP, the meteorological data for all 24 hours of a day is input together, even if CO computations are to be made for only a few hours of the day. This is necessary for program efficiency. Since the stability class for each hour of the day will be found during dispersion calculations for the first hour, no card type 10 is input with traffic and site data for subsequent hours until a new day is to be run. If the wind is calm, wind speed should be input on card type 10 as 1.94 knots (1 m/sec) and the wind direction from the previous time period should be used.

SECTION 5

SAMPLE APPLICATION

For a sample application of the modified ISMAP model we have chosen the configuration of links, intersections, zones and receptors shown in Figure 12. For this particular example the traffic flow within the network is generated by means of vehicle attractions and generations for six interior zones and six exterior zones. When setting up a network such as this one, it must be remembered that vehicles cannot be routed between two interior zones or two exterior zones. For each of the interior zones a gate has been designated with associated incoming and outgoing links. A total of nine receptor locations are used in this simulation with the central receptor considered to be a street canyon receptor.

A listing of the model input cards for this sample case follows Figure 12. The format for each card is given by Table 2. The first card in the list is the leader card which gives the date for which the simulation is being carried out (not the date of the computer run), the run identities and a flag in column 80 which must be set equal to 1 for the modified version of ISMAP to be run properly. The following card (card 1) indicates that for the simulation there will be 48 links, 9 intersections, 12 zones, 1 type 5 card, 6 gates, 3 vehicle types, no VMT which is not due to zone attractions, 9 receptor locations and 1 hour's worth of meteorological data. Also input to the program on this card is the hour of the day (8), time period duration (3600 sec), total trips attracted to the interior zones (1800), total trips generated by the interior zones (300), parking density constant (360 ft² - not used) and the number of iterations to be used in the route selection process (3). For each link a type 2 card is required giving number of lanes, endpoint coordinates in feet, cruise speed on the link (ft/sec), link connections (going straight, turning right and turning left), and emission height (meters). For example, if we follow link 21 along the direction from the first pair of endpoint coordinates to the second, we meet links 23, 46 and 47. For each of the links used in this example the cruise speed was assumed to be 58 ft/sec (40 mi/hr) and the emission height set equal to zero. For each of the nine intersections a type 3 card is provided giving the identification numbers of links approaching the intersection; signalization type (fixed time for the example case); cycle time (200 sec); duration of North-South, East-West, North-South left turn and East-West left turn phases (75, 75, 25, 25 sec); and yellow time interval (3 sec). The default value of 1200 veh/hr/lane was used as the capacity of each phase. The card type 4 entries identify the interior zones (01-06) and the exterior zones and give the number of trips attracted to or generated by the zone as a fraction of total trips attracted to and generated by all interior and exterior zones. The percentage values

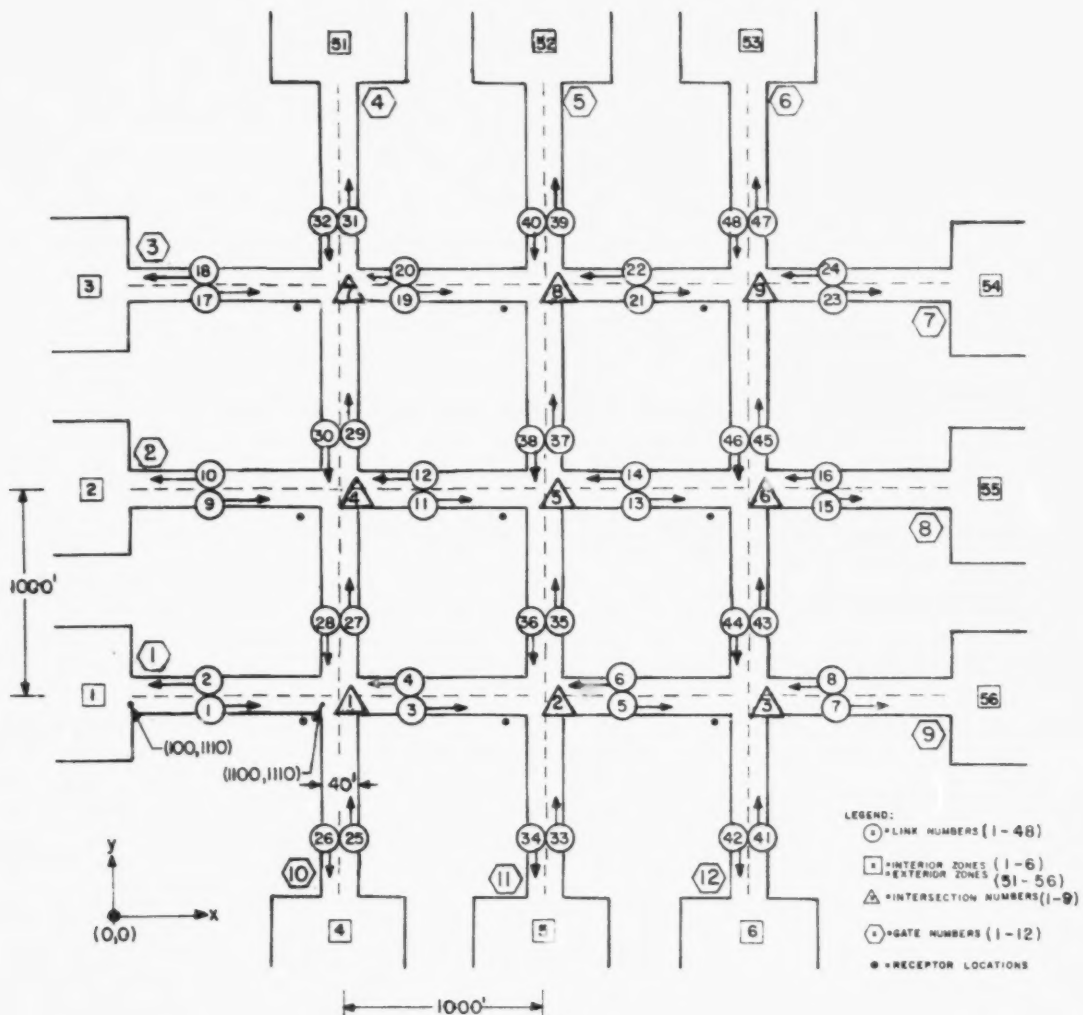


Figure 12. Diagram for test case of modified ISMAP.

INDIRECT SOURCE MODEL FOR AIR POLLUTION (ISHAP), INPUT DATA E P A

000056	000	3	06	46	16	42	13	1	200	75.	75.	25.	25.	3.
000057	000	7	07	32	20	29	17	1	200	75.	75.	25.	25.	3.
000058	000	5	08	40	22	37	19	1	200	75.	75.	25.	25.	3.
000059	000	3	09	48	24	45	21	1	200	75.	75.	25.	25.	3.
000060	000	4	52	12.	45	12.	12.	1	07	08				
000061	000	4	55	12.	12.	12.	12.	1	15	16				
000062	000	4	54	12.	12.	12.	12.	1	23	24				
000063	000	4	53	12.	12.	12.	12.	1	47	48				
000064	000	4	52	12.	12.	12.	12.	1	39	40				
000065	000	4	51	12.	12.	12.	12.	1	31	32				
000066	000	4	40	12.	12.	12.	12.	1	41	42				
000067	000	4	05	12.	12.	12.	12.	1	33	34				
000068	000	4	04	12.	12.	12.	12.	1	25	26				
000069	000	4	31	12.	12.	12.	12.	1	17	18				
000070	000	4	21	12.	12.	12.	12.	1	9	10				
000071	000	4	11	12.	12.	12.	12.	1	1	2				
000072	000	5	0	0	0	0	0	0	0	0	0	0	0	0
000073	000	6	01	02	03	04	05	06	07	08	09	10	11	12
000074	000	6	09	10	11	12	13	14	15	16	17	18	19	20
000075	000	6	17	18	19	20	21	22	23	24	25	26	27	28
000076	000	6	41	42	43	44	45	46	47	48	49	50	51	52
000077	000	6	33	34	35	36	37	38	39	40	41	42	43	44
000078	000	6	25	26	27	28	29	30	31	32	33	34	35	36
000079	000	7	1	01	02	03	04	05	06	07	08	09	10	11
000080	000	7	2	15	16	17	18	19	20	21	22	23	24	25
000081	000	7	3	02	03	04	05	06	07	08	09	10	11	12
000082	000	9	100	100	100	100	100	100	100	100	100	100	100	100
000083	000	9	200	200	200	200	200	200	200	200	200	200	200	200
000084	000	9	300	300	300	300	300	300	300	300	300	300	300	300
000085	000	9	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
000086	000	9	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
000087	000	9	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
000088	000	9	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
000089	000	9	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
000090	000	9	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000
000091	000	10	120	120	120	120	120	120	120	120	120	120	120	120

END ELT.

SECRET PRINTS

INDIRECT SOURCE MODEL FOR AIR POLLUTION (ISHAP). - OUTPUT EPA

OUTPUT

[illegible]

PARKING ZONE CAPACITIES AND LENGTHS NOT USED IN THE CALCULATION

TRAFFIC SUBMODEL

[illegible]

INTERSECTION 1		PHASE 1		PHASE 2		PHASE 3		PHASE 4	
TIME	75.	138C3	0.0007	WEST-AP	0.0007	25.	0.04167	25.	0.08333
N/C		SOUTH-AP	40.	EAST-AP	40.	77.	0.04167	77.	0.08333
DELTA	40.	40.	0.	40.	0.	0.	0.	0.	0.
QUEUE	0.	0.	0.	174.	50.	0.	0.	0.	0.
VOLUME	400.	50.	50.	1217.	141.	141.	141.	141.	141.
CAPACITY	1055.	1065.	1065.	0.06007	0.01510	0.04167	0.00000	0.04167	0.00000
N/CAP	13003	01725							
INTERSECTION 2		PHASE 1		PHASE 2		PHASE 3		PHASE 4	
TIME	75.	10352	0.0690	75.	0.0690	25.	0.00476	25.	0.05566
N/C		10352							

INDIRECT SOURCE MODEL FOR AIR POLLUTION (ISMAP).

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DELTA	NORTH-AP	SOUTH-AP	EAST-AP	WEST-AP	N-AP-LFT	S-AP-LFT	E-AP-LFT	W-AP-LFT
QUEUE	44.	40.	42.	40.	77.	77.	87.	93.
VOLUME	300.	0.	0.	0.	0.	0.	0.	0.
CAPACITY	1065.	44.	210.	61.	5.	6.	50.	67.
V/GCAP	.1052	.1150	1118.	1065.	141.	141.	141.	141.
		.01415	.06890	.02104	.00384	.00476	.04167	.05566

INTERSECTION 3

TIME	PHASE 1	PHASE 2	PHASE 3	PHASE 4
V/GC	75.	75.	25.	25.
	.07548	.08235	.04960	.04167
DELTA	NORTH-AP	WEST-AP	S-AP-LFT	W-AP-LFT
QUEUE	43.	39.	90.	77.
VOLUME	250.	0.	0.	0.
CAPACITY	1217.	21.	60.	50.
V/GCAP	.07548	1217.	141.	141.
	.02467	.00647	.04960	.04167
				.00000

INTERSECTION 4

TIME	PHASE 1	PHASE 2	PHASE 3	PHASE 4
V/GC	75.	75.	25.	25.
	.22429	.01510	.04167	.01934
DELTA	NORTH-AP	WEST-AP	S-AP-LFT	W-AP-LFT
QUEUE	53.	39.	87.	77.
VOLUME	1.	0.	0.	0.
CAPACITY	650.	27.	50.	23.
V/GCAP	1065.	1217.	141.	141.
	.22429	.00809	.04167	.01934
	.01399			

INTERSECTION 5

TIME	PHASE 1	PHASE 2	PHASE 3	PHASE 4
V/GC	75.	75.	25.	25.
	.05051	.01510	.04167	.12500
DELTA	NORTH-AP	WEST-AP	S-AP-LFT	W-AP-LFT
QUEUE	41.	39.	77.	77.
VOLUME	0.	0.	0.	0.
CAPACITY	150.	27.	0.	0.
V/GCAP	1417.	1130.	141.	141.
	.04520	.00871	.00000	.12500
	.05051			

INTERSECTION 6

TIME	PHASE 1	PHASE 2	PHASE 3	PHASE 4
V/GC	75.	75.	25.	25.
	.08115	.08235	.00459	.05509
DELTA	NORTH-AP	WEST-AP	S-AP-LFT	W-AP-LFT
QUEUE	43.	41.	77.	92.
VOLUME	235.	0.	0.	0.
CAPACITY	1065.	94.	0.	66.
V/GCAP	.08115	1065.	141.	141.
	.02951	.03261	.00000	.04167
				.05509

INTERSECTION 7

TIME	PHASE 1	PHASE 2	PHASE 3	PHASE 4
V/GC	75.	75.	25.	25.
	.08235	.07785	.04167	.37500
DELTA	NORTH-AP	WEST-AP	S-AP-LFT	W-AP-LFT
QUEUE	43.	40.	77.	78.
VOLUME	0.	0.	0.	0.
CAPACITY	1065.	43.	0.	0.
V/GCAP	.08115	1065.	141.	141.
	.02951	.03261	.00000	.04167
				.05509

INDIRECT SOURCE MODEL FOR AIP POLLUTION (ISMAP).

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- OUTPUT

CAPACITY 1045.
V/GCAP .12377

INTERSECTION 4

PHASE 1
75.
SOUTH-AP
40.
NORTH-AP
46.
VOLUME
430.
CAPACITY
1065.
V/GCAP .13903

PHASE 2
75.
WEST-AP
40.
EAST-AP
42.
VOLUME
192.
CAPACITY
1106.
V/GCAP .06376

PHASE 3
25.
S-AP-LFT
81.
N-AP-LFT
88.
VOLUME
54.
CAPACITY
141.
V/GCAP .04496

PHASE 4
25.
W-AP-LFT
78.
E-AP-LFT
115.
VOLUME
1.
CAPACITY
100.
V/GCAP .08333

PHASE 1
75.
SOUTH-AP
41.
NORTH-AP
44.
VOLUME
320.
CAPACITY
1065.
V/GCAP .10352

PHASE 2
75.
WEST-AP
41.
EAST-AP
42.
VOLUME
176.
CAPACITY
1179.
V/GCAP .05492

PHASE 3
25.
S-AP-LFT
77.
N-AP-LFT
81.
VOLUME
25.
CAPACITY
141.
V/GCAP .02083

PHASE 4
25.
W-AP-LFT
96.
E-AP-LFT
96.
VOLUME
1.
CAPACITY
75.
V/GCAP .06250

PHASE 1
75.
SOUTH-AP
40.
NORTH-AP
45.
VOLUME
329.
CAPACITY
1065.
V/GCAP .11359

PHASE 2
75.
WEST-AP
41.
EAST-AP
42.
VOLUME
225.
CAPACITY
1161.
V/GCAP .07123

PHASE 3
25.
S-AP-LFT
87.
N-AP-LFT
77.
VOLUME
0.
CAPACITY
141.
V/GCAP .00229

PHASE 4
25.
W-AP-LFT
103.
E-AP-LFT
96.
VOLUME
1.
CAPACITY
75.
V/GCAP .06250

PHASE 1
75.
SOUTH-AP
40.
NORTH-AP
43.
VOLUME
275.
CAPACITY
1125.
V/GCAP .08984

PHASE 2
75.
WEST-AP
40.
EAST-AP
42.
VOLUME
203.
CAPACITY
1170.
V/GCAP .06157

PHASE 3
25.
S-AP-LFT
87.
N-AP-LFT
81.
VOLUME
0.
CAPACITY
141.
V/GCAP .02083

PHASE 4
25.
W-AP-LFT
78.
E-AP-LFT
2452.
VOLUME
65.
CAPACITY
225.
V/GCAP .18750

PHASE 1
75.
SOUTH-AP
40.
NORTH-AP
44.
VOLUME
300.
CAPACITY
1065.
V/GCAP .10352

PHASE 2
75.
WEST-AP
40.
EAST-AP
43.
VOLUME
300.
CAPACITY
1217.
V/GCAP .09058

PHASE 3
25.
S-AP-LFT
77.
N-AP-LFT
77.
VOLUME
0.
CAPACITY
141.
V/GCAP .00000

PHASE 4
25.
W-AP-LFT
79.
E-AP-LFT
537.
VOLUME
15.
CAPACITY
150.
V/GCAP .12500

PHASE 1
75.
SOUTH-AP
40.
NORTH-AP
44.
VOLUME
300.
CAPACITY
1065.
V/GCAP .10352

PHASE 2
75.
WEST-AP
40.
EAST-AP
43.
VOLUME
300.
CAPACITY
1217.
V/GCAP .09058

PHASE 3
25.
S-AP-LFT
77.
N-AP-LFT
77.
VOLUME
0.
CAPACITY
141.
V/GCAP .00000

PHASE 4
25.
W-AP-LFT
79.
E-AP-LFT
537.
VOLUME
15.
CAPACITY
150.
V/GCAP .12500

INDIRECT SOURCE MODEL FOR AIR POLLUTION (ISMAR), - OUTPUT

INTERSECTION 9

TIME			
W/C			
DELA	NORTH-AP	SOUTH-AP	PHASE 1
QUEUE	44	40	75
VOLUME	0	0	*10352
CAPACITY	300		
W/CAP	1065		
COUNTS	*10352		*2012

EAST-AP
42.
0.
225.
1217.
.06793

PHASE 2
75.
06793
WEST-AP
40.
0.
65.
1065.
02250

PHASE 3	N-AP-LFT	S-AP-LFT
25.	77.	87.
.04167	0.	0.
	0.	50.
	141.	141.
	.00000	.04167

PHASE 4	E-AP-LFT
25.	96.
0.6250	1.
W-AP-LFT	75.
80.	141.
0.	0.6250
19.	
141.	
0.1563	

[illegible]

INTERSECTION 1

IME	PHASE 1
/6C	75.
	-09777
ELA	SOUTH-AP
UFUE	4C.
OLUME	0.
APACITY	50.
ECAP	1096.
	-C1677

EAST-AP
43-
0-
232-
1111-
07667

PHASE 2
75.
.07667
WEST-AP
40.
0.
50.
1217.
.01510

PHASE 3	
25.	
.02778	
S-AP-LFT	
77.	P3.
0.	0.
0.	33.
141.	141.
.00000	.02778

PHASE 4	W-AP-LFT	E-AP-LFT
25.	250.	250.
.1111	6.	6.
	133.	133.
	141.	141.
	.1111	.1111
	0.	0.
	141.	141.
	.0000	.0000

INTERSECTION 2

IME		NORTH-AP	PHASE 1
/FC		4C.	75.
		UEUE	-D92C2
ELA	64.	Q.	SOUTH-AP
OLWE	267.	C.	4C.
APACITY	1025.		4E.
6CAP	.09202		1097.
			.01611

EAST-AP
46.
0.
367.
1074.
12570

PHASE 2
75.
• 12570
WEST-AP
40.
0.
44.
1065.
• 01516

PHASE 3	PHASE 2	PHASE 1
25.	25.	25.
.01596	.01596	.01596
S-AP-LFT	S-AP-LFT	S-AP-LFT
77.	77.	77.
0.	0.	0.
2.	2.	2.
141.	141.	141.
.00159	.00159	.00159

PHASE 4	W-AP-LFT	E-AP-LFT
25.	146.	2.
.09722	87.	117.
	0.	141.
	51.	.09722
	141.	
	.04282	

INTERSECTION

PHASE 1	
IME	75%
/EC	149.57
	SOUTH-AP
ELA	41%
UEUE	47%
	NORTH-AP
VOLUME	0%
	43%
CAPACITY	105%
ECAP	149.57
	106%
	106.5%
	1034.55

AST-AP
43.
0.
250.
1950.
-07992

WASE 2
75.
07992
WEST-AP
60.
0.
50.
1065.
01712

PHASE 3	PHASE 2	PHASE 1	PHASE 0
25.	25.	25.	25.
.04211	.04211	.04211	.04211
S-AP-LFT	S-AP-LFT	S-AP-LFT	S-AP-LFT
87.	87.	87.	87.
0.	0.	0.	0.
51.	51.	51.	51.
141.	141.	141.	141.
.04211	.04211	.04211	.04211

E-AP-LFT	87.	0.	50.	141.	0.4167
W-AP-LFT	78.	0.	8.	141.	0.0687
PHASE 4	25.	0.4167			

INTERSECTION 7

V/C		NORTH-AP		SOUTH-AP		EAST-AP		WEST-AP		N-AP-LFT		S-AP-LFT		E-AP-LFT		W-AP-LFT																																																																																																																																																																																																																																																													
DELA	10352	44.	40.	41.	41.	0.	0.	0.	0.	77.	83.	250.	1111	79.	1111	1111	1111																																																																																																																																																																																																																																																												
QUEUE		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.																																																																																																																																																																																																																																																												
VOLUME		300.	60.	167.	167.	98.	98.	98.	98.	141.	141.	141.	141.	141.	141.	141.	141.																																																																																																																																																																																																																																																												
CAPACITY		1065.	1065.	1217.	1217.	1065.	1065.	1065.	1065.	141.	141.	141.	141.	141.	141.	141.	141.																																																																																																																																																																																																																																																												
V/CAP		10352	02077	05032	05032	05032	05032	05032	05032	00000	02778	02778	02778	02778	02778	02778	02778																																																																																																																																																																																																																																																												
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EMISSIONS SUPMODEL

EMISSION = 1
 CAR = 77
 EMP-COLD-HOT-COLD = 50.000 .200 .060 .000
 MIX = .750 .050 .090 .000

EMISSION COFRECTION

1.422399 1.440174 1.435166
 1.404052 1.406090 1.443988
 1.472240 1.467815 1.512240
 1.715649 1.931629 2.043941

EMISSIONS

LINK NSTOPS

WLEN6TH

COUNT

SPEED

E AT SPEED

DISTANCE

E DECEL

DISTANCE

E IDLE

DISTANCE

E ACCEL

DISTANCE

E ACCEL

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INDIRECT SOURCE MODEL FOR AIR POLLUTION (ISMAP), - OUTPUT

DATE 072079

PAGE

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E P A

```

35 0 .0000 .5000+02 .5740+02 .2303-03 .3048+03 .0000 .0000 .0000 .0000
40 210 .5486+02 .3000+03 .5438+02 .1363-02 .1078+03 .4039-02 .1671+02 .8056-01 .1144-01 .0000
41 110 .2181+02 .1507+02 .5618+02 .6713-03 .1058+03 .2036-02 .6658+01 .8051-01 .5950-02 .9012+02
42 0 .0000 .3000+03 .5438+02 .1363-02 .1078+03 .2036-02 .6658+01 .8051-01 .5950-02 .9012+02
43 70 .1570+02 .1004+03 .5666+02 .4921-03 .1043+03 .0000 .0000 .0000 .0000 .0000
44 320 .2824+02 .3563+03 .5273+02 .1997-02 .1084+03 .1511-02 .9785+02 .9028-01 .4786+01 .0000
45 67 .1279+02 .6352+02 .5687+02 .4140-03 .1037+03 .6105-02 .8474+02 .7999-01 .2689+02 .0000
46 321 .8806+02 .4398+03 .5269+02 .2014-02 .1087+03 .1279-02 .9858+02 .9289-01 .3894+01 .0000
47 0 .0000 .5000+02 .5740+02 .2303-03 .3048+03 .0000 .0000 .0000 .0000
48 209 .5741+02 .5000+03 .5438+02 .1363-02 .1071+03 .4026-02 .1750+02 .7779-01 .1139-01 .0000

```

SUBROUTINE STREET CALLED FOR RECEPTOR 5 AND LINK 11

2.00

```

5 I= 11 M= 1.25 BMT= 21.34 RHT= 1.52 XLO=
5 I= 11 DXT= 304.80 DYT= .00 SL= 304.80
5 I= 11 II= 1 DX(II)= 102.95 DY(II)= .00
5 I= 11 II= 2 DX(II)= 98.72 DY(II)= .00
5 I= 11 II= 3 DX(II)= 4.42 DY(II)= .00
5 I= 11 II= 4 DX(II)= 98.72 DY(II)= .00

```

```

JJ= 1 M= 5 XX(JJ)= .787+03
YY(JJ)= .643+03 X0(M)= .610+03 Y0(M)= .637+03
DTS= .221+03

```

```

JJ= 2 M= 5 XX(JJ)= .488+03
YY(JJ)= .643+03 X0(M)= .610+03 Y0(M)= .637+03
DTS= .122+03

```

```

JJ= 3 M= 5 XX(JJ)= .536+03
YY(JJ)= .643+03 X0(M)= .610+03 Y0(M)= .637+03
DTS= .707+02

```

```

JJ= 4 M= 5 XX(JJ)= .591+03
YY(JJ)= .643+03 X0(M)= .610+03 Y0(M)= .637+03
DTS= .191+02

```

```

11 JKEEP= 4 0(I,JKEEP)= .328-02
5 I= 11 JKEEP= 4 CW= .379-03 CL= .663-03
5 I= 11 EPSIL= 30.00

```

SUBROUTINE STREET CALLED FOR RECEPTOR 5 AND LINK 12

2.00

```

5 I= 12 M= 1.25 BMT= 21.34 RHT= 1.52 XLO=
5 I= 12 DXT= -304.80 DYT= -54.90 SL= 309.70
5 I= 12 II= 1 DX(II)= -112.22 DY(II)= -20.21
5 I= 12 II= 2 DX(II)= -88.77 DY(II)= -15.99
5 I= 12 II= 3 DX(II)= -15.03 DY(II)= -2.71
5 I= 12 II= 4 DX(II)= -88.77 DY(II)= -15.99

```

```

JJ= 1 M= 5 XX(JJ)= .584+03
YY(JJ)= .694+03 X0(M)= .610+03 Y0(M)= .637+03
DTS= .625+02

```

```

JJ= 2 M= 5 XX(JJ)= .482+03
YY(JJ)= .676+03 X0(M)= .610+03 Y0(M)= .637+03
DTS= .132+03

```

```

JJ= 3 M= 5 XX(JJ)= .432+03
YY(JJ)= .667+03 X0(M)= .610+03 Y0(M)= .637+03
DTS= .180+03

```

```

JJ= 4 M= 5 XX(JJ)= .360+03
YY(JJ)= .657+03 X0(M)= .610+03 Y0(M)= .637+03
DTS= .231+03

```

```

12 JKEEP= 1 0(I,JKEEP)= .135-02
5 I= 12 JKEEP= 1 CW= .156-03 CL= .273-03
5 I= 12 EPSIL= 30.00

```

INDIRECT SOURCE MODEL OF AIR POLLUTION

EXAMPLE HOT SPOT CALCULATION WITH MODIFIED ISMAP

DATE = 770301

NO. OF LINKS = 48	NO. OF ZONES = 12	NO. OF INTERSECTIONS = 9
-------------------	-------------------	--------------------------

MCUF = 8. WIND DIRECTION = 120. WIND SPEED = 2.6+00 STABILITY = 4

RECEPTOR

CO CONCENTRATION (PPM)

7 -	9	1.63-01	1.84-01	3.22-01	5.54-01	1.28+00	3.06-01	5.39-01	5.22-01	2.70-01
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INDIRECT SOURCE MODEL FOR AIR POLLUTION (ISMAL), - OUTPUT

E P A

DATE 072079 PAGE

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NORMAL EXIT. EXECUTION TIME: 16466 MILLISECONDS.

6PRFT PRINTS

need not add to 100 since they are renormalized within the program. In our example the total trips attracted to and generated by all interior zones are distributed equally among the interior zones. The same procedure was followed in the case of exterior zones. According to this configuration each interior zone will attract 300 trips and generate 50 while each exterior zone will generate 300 trips and attract 50. Again, it should be noted that the terms interior and exterior no longer necessarily refer to the relative locations of zones but simply to define two groups of zones between which travel can occur. Card type 5 contains site description information and vehicle population characteristics while the card 6 entries specify the links comprising the gates entering the six interior zones. Card 7 gives the average number of passengers per vehicle for three vehicle types: automobiles, buses and trucks. No card type 8 is shown in the input listing since all trips are assumed to be generated. The location of each of the nine receptors is given on a separate card 9. The fifth receptor is designated as a street canyon receptor with the appropriate street and building characteristics. On card 10 a single hour's meteorological data is specified.

The first portion of the program output is simply a listing of the model input data with the receptor coordinates converted from feet to meters. The next part of the output is the parking zone capacities and parking zone trip lengths which are not used in the modified ISMAP calculations. Results of the traffic calculations are presented for each of the three iterations on an intersection by intersection and phase by phase basis. For each phase the volume to green time capacity ratio, average delay (sec), average queue length (vehicles), volume (vehicles/hour), capacity (vehicles/hour) and controlling volume to hour of green capacity ratio. Before the listing of intersection and phase parameters for the final iteration, a listing of vehicle counts on each link are printed out for vehicles going straight (thru), turning right (rt), turning left (lt) or terminating at a zone (term). Following a listing of parking lot parameters which are not used by the modified version of the program, the link travel times for going straight, turning right and turning left are printed out followed by listing of overall network travel times, delays and average queue lengths. Emission rates (g/m/sec) for each link are then printed out for different travel modes as follows:

- LINK - Link number.
- NSTOPS - Number of vehicles that stop on this link during the simulated time period.
- QLENGTH - Average queue length experienced by all stopping vehicles, starting at the downstream intersection, ft.
- COUNT - Number of vehicles using the link.
- SPEED - Average speed of vehicles when unaffected by starting or stopping movements at the intersection, ft/sec.

E AT SPEED - Emission rate of vehicles traveling at SPEED, in $\text{gm sec}^{-1} \text{ m}^{-1}$.

DISTANCE - Distance over which the E AT SPEED emission rate applies, m.

E DECEL - Emission rate of vehicles while decelerating from SPEED to a stopped position, $\text{gm sec}^{-1} \text{ m}^{-1}$.

DISTANCE - Distance over which the E DECEL rate applies, m.

E IDLE - Emission rate of idling vehicles, $\text{gm sec}^{-1} \text{ m}^{-1}$.

DISTANCE - Distance over which the E IDLE rate applies, m.

E ACCEL - Emission rate of accelerating vehicles, $\text{gm sec}^{-1} \text{ m}^{-1}$.

DISTANCE - Distance over which the E ACCEL rate applies, m.

Finally the hour of the day and meteorological data are entered.

The output from the program consists of (1) a display of the input parameters; (2) a listing of the parking zone capacities and the average trip lengths within each zone; (3) traffic computations for each intersection in the network; (4) a summary of the travel times on each link; (5) a summary tabulation for the entire network showing total network travel time, total travel time in parking zones (always 0), network vehicle-miles of travel, total intersection delay, number of vehicle stops occurring, and the total of the average queue length; (6) link emission data summary; and (7) a summary showing the number of links, zones and intersections considered, the meteorological parameters used, and the resulting CO concentrations for each receptor.

Various codes used in the output are defined below:

TIME is the computed signal phase time (sec).

V/GV is the ratio of the highest approach volume to the approach capacity per hour of green signal time, at an intersection.

NORTH-AP, SOUTH-AP, EAST-AP, WEST-AP are the designations of the intersection's north, south, east and west approaches, respectively.

N-AP-LFT, S-AP-LFT, E-AP-LFT, W-AP-LFT are the designations of the left-turn phases from the intersection's north, south, east, and west approaches, respectively.

DELA is the computed delay time.

QUEUE is the average number of vehicles queued per cycle.

VOLUME is the traffic volume in vehicles per hour.

CAPACITY is the number of vehicles that could pass over a link taking into account interruptions to flow from traffic signals, pedestrians, slow moving vehicles, etc.

V/GCAP is the ratio of the approach volume to the approach capacity per hour of green signal time, for a specific intersection approach.

SECTION 6

USE OF THE MODIFIED ISMAP MODEL IN CONJUNCTION WITH APRAC

Since the modified ISMAP is not designed to handle a large number of traffic links, the concentrations calculated for the model receptor locations will certainly not reflect the carbon monoxide contributions from the remainder of the urban area. If application of the model shows that concentrations close to the standard might be expected, then some means must be found to include the remaining links of the traffic network in the analysis. For those receptors located quite close to roadways or intersections the contribution of other link emissions to the carbon monoxide concentration is often small in comparison to the contribution of the roadway or intersection in question. On the other hand, for those receptors not immediately adjacent to the roadway or intersection, this contribution can become a much greater fraction of the total concentration especially in a large urban area and when a low mixing prevails for an extended period of time.

One method to obtain quantitative estimates of the contributions of links not included in the modified ISMAP is by use of the APRAC-1A^{8,10,11,12} or APRAC-2¹⁵ computer models, which are designed for the prediction of hourly CO concentrations at specific receptor locations based upon traffic link emissions and meteorological data. The concentration contribution at a particular receptor location from links other than the receptor street is calculated by means of a receptor oriented Gaussian plume model. For a given hour the model sets up a series of area sources upwind of the receptor point. Each of these area sources is assigned an emission strength based upon the link elements contained within each. The vertical dispersion of the CO plume which occurs between the area source and receptor will depend upon a vertical dispersion parameter which is in turn a function of windspeed, cloud cover, and time of day. The dilution factor of CO along the axis of the plume is proportional to the windspeed.

For the most part, the differences between APRAC-1A and APRAC-2 are insignificant when the models are used to estimate the intra-urban background or mesoscale component. Most users will find APRAC-1A preferable, in that it costs one-quarter to one-half as much as APRAC-2 to execute. The principal differences between the models and their importance in the application considered here are reviewed below:

- Emissions Calculation - In the APRAC-1A program emissions, E, are parameterized simply in the form of an emission factor power law as:

$$E = \alpha S^{-\beta}$$

where E = emission factor (gm/veh/mi)

α, β = constants for a particular year, model year distribution, and weighted annual travel distribution

S = average traffic speed (mi/hr)

The speed S is available for the emission factor calculation since each link in the data set is characterized by one of eight speed classes.

This formulation, compared to APRAC-2 is very inexpensive in terms of computer time. One minor complication is that the α and β constants must be calculated for the emission characteristics of the vehicle populations. This implies that only one value of cold starts and the other emission parameters are applied universally. A different year or time period would require new constants.

APRAC-2, on the other hand, explicitly calculates the emission factors according to Supplement 5 of AP-42. Different cold starts proportions can be applied to separate locations in a region and different time periods. A unique speed on each link can be input or speed can be calculated using a capacity restraint model. Consequently, APRAC-2 can calculate emissions with much greater sensitivity. The effect of such an enhancement on the calculation of the mesoscale component is unknown. (ISMAP, of course, is sensitive to these parameters and they are considered in the calculations of the microscale component.) APRAC-2 can be updated to reflect the new motor vehicle emission factors.¹⁶

- Multiple Wind Field - APRAC-2 can accommodate wind measurements from multiple locations in the region; unique values of speed and directions are then interpolated for each receptor. Where such data are available and show significant variation, the use of APRAC-2 should be considered.
- Local Source Models - APRAC-1A and APRAC-2 provide for the use of a street canyon sub-model; APRAC-2 also provides for the use of an intersection sub-model. Since ISMAP already treats these situations, these options should not be used again when APRAC is used to calculate the mesoscale component.

- Dispersion Model Options - The following options are available to the user of the APRAC-1A model:
 - Synoptic Calculation - Source receptor relationships are recalculated for each new hour of meteorological data. This option should be used if the program is being run to simulate only a limited number of hours (e.g., 24 hours).
 - Climatological Calculation - Source receptor relationships are calculated at the beginning of the program for a wide range of meteorological configurations and written on a direct access device. The appropriate normalized concentrations for each source-receptor pair are then reread for the meteorological configuration which prevails at a given hour. The climatological option should be used for the simulation of a large number of hours. The final decision as to whether the synoptic or climatological options should be used must also depend upon the relative cost of CPU time and direct access I/O at the facility where the model is being run.
 - Grid Point Calculation - Carbon monoxide concentrations are calculated at up to 625 receptor locations for a specified hour of the day. This option would not be especially useful in conjunction with the application of the IMM since the user would be more interested in the concentration at a small number of receptors for more than a single hour.

The APRAC-2 model has retained these options; however, the choice is implicit depending on the input data supplied to APRAC-2. APRAC-2 limits a user to 10 receptors for a 24-hour execution and one receptor for a multiday execution.

- Traffic Volume Data - The basic traffic input for the APRAC-1A model is the number of vehicles per day for an array of links whose endpoint coordinates are specified on a rectangular system in units of 0.01 miles. To account for the curvature of a particular link, the actual length of the roadway between the endpoint is input. Each link is also assigned an appropriate speed classification. Nonlink traffic volumes may be assigned to grid squares superimposed upon the traffic network. The daily traffic flow volume is apportioned for each hour of the day according to hourly traffic flow distributions specific to weekdays, Saturdays, and Sundays. There is also the option in the program of selecting a given hour of the day as a peak hour.

APRAC-2 treats link based traffic data in a similar manner. In addition, APRAC-2 has an option for accepting FHWA type binary link file via a preprocessor. Nonlink traffic volume can be assigned the same way as APRAC-1A or can automatically be computed by the mode. Daily traffic flow is apportioned for each hour according to diurnal distributions as in APRAC-1A. However, instead of diurnal factors for five facility types as in APRAC-1A, APRAC 2 requires diurnal distributions for two facility types, for two directions, for 5 locals (i.e., CBD, commercial, residential, industrial and rural) - a total of 20. There is no peak hour factor.

Appendix A
PROGRAM LISTING

COMPUTER PROGRAM SOURCE CODE,

ISMAP MODEL

.X A.

```
C      DATA SET PTISMAP7   AT LEVEL 016 AS OF 07/13/78
C      ***** PTISMAP   INDIRECT SOURCE MODEL FOR AIR POLLUTION *****
C
C      MODIFIED ISMAP VERSION 2
C
C      PREPARED BY GCA/TECHNOLOGY DIVISION
C      PURLINGTON ROAD, BEDFORD MASSACHUSETTS
C      (617) 275-9000
C
C      VERSION 2 PREPARED BY FRANK BENESH INCORPORATING THE
C      NEW MOTOR VEHICLE EMISSION FACTORS AND MODAL MODEL
C      COEFFICIENTS AND DETERIORATION RATES
C
C      VERSION 1 PREPARED BY MICHAEL T. MILLS INCORPORATING THE
C      STREET CANYON MODEL AND DISABLING THE PARKING SUBROUTINE
C
C      PREPARED UNDER CONTRACT WITH THE U.S. E.P.A.
C      SOURCE RECEPTOR ANALYSIS BRANCH
C      RESEARCH TRIANGLE PARK, NORTH CAROLINA
C      GEORGE SCHEVE, PROJECT OFFICER
C
C      *****
C      COMMON / COMM / I,Z,L,J,K, TOL, DOW, TP, TOTATT, TTPZ,TOTGEN,ITM
C      1,NYEAR,LHEAD(18), TUNFAC
C      INTEGER Z
C      COMMON / LINK / NLINK, NLANE(200), X1(200), Y1(200), X2(200), Y2(200)
C      1),LCAP(200),DIST(200), VFL(200), LCON(200,3)
C      2,NSTOPS(200)
C      COMMON / INTRST / NINS, LIN(70,4),ITYPE( 70), CYCL(70), PH(70,4),
C      1 CI(70), GCAP(70,4), QUE(70,4)
C      COMMON / ZONES / NZONES, NZLINS(50), ZLINKS(12,50), ZATTR(50),
C      17GENR (50), NEXT, ZAT(2), ZGT(2), ZVT(3,50), ZNAME(50)
C      INTEGER ZLINKS,ZNAME
C      COMMON / GATE / NGATE, LGATE(2,10), VCR(10, 2,4)
C      COMMON / VOLUME / COUNT(4,200)
C      COMMON / PARKZ / PZ, PV(50),PLA(50), V7(50), ZV(50),PD,PLS,PLBO
C      1, PNO(50), PLL(50)
C      INTEGER PNO5
```

```

INTEGER PZ,PZ1
COMMON /VEHTYP/ VT,VTP(3), VTE(3), VTMLT(2), SZVTP(3,2)
COMMON/EXCLUD/NOPARK
COMMON TT(200,3),DFLA(200,3),PRT(50),QUEUE(200)
1, EMISS(200,4)
DATA IST/0/
DO 12 I13=1,200
DO 12 I14=1,3
LCON(I13,I14)=0
12 TT(I13,I14)=0.0
1 DO 11 J1=1,4
DO 11 J2=1,200
11 COUNT(J1,J2)=0.
CALL INPT
C TEST FOR FIRST TIME THRU AND INITIALIZE IF TRUE
14 IF (IST .GE. 1) GO TO 3
IST = 1
CALL ZAREA
C
C INITIALIZE VOLUME TO CAPACITY RATIO INVERSES
DO 2 IG = 1,NGATE
DO 2 K=1,2
DO 2 J = 1,4
VCR(IG,K,J) = 2.0
2
C
C INITIALIZE LINK TO LINK TRAVEL TIMES
DO 22 L = 1,NLINK
DIST(L) = SQRT((X1(L)-X2(L))**2+(Y1(L)-Y2(L))**2)
TTIME = DIST(L)/VEL(L)/NLANE(L)
DO 22 J = 1,3
TT (L,J) = TTIME
22
C INITIALIZE PARKING LOT LENGTH (THE LENGTH OF THE LONGEST SIDE IS
C STORED IN PLL(Z)
IZ = NEXT + 1
DO 24 Z= IZ,NZONES
IF(PLL(Z) .LT. 0.0) PLL(Z) = -(PLL(Z) + PLA(Z)/PLL(Z) )
PLL(Z) = AMAX1(PLL(Z),1.0)
24 CONTINUE
C
C ROUTE VEHICLES SPECIFIED AS TOTALT (TOTAL TRIPS ATTRACTED AND GENERAT
MAI00410
MAI00420
MAI00430
MAI00440
MAI00450
MAI00460
MAI00470
MAI00480
MAI00490
MAI00500
MAI00510
MAI00520
MAI00530
MAI00540
MAI00550
MAI00560
MAI00570
MAI00580
MAI00590
MAI00600
MAI00610
MAI00620
MAI00630
MAI00640
MAI00650
MAI00660
MAI00670
MAI00680
MAI00690
MAI00700
MAI00710
MAI00720
MAI00730
MAI00740
MAI00750
MAI00760
MAI00770
MAI00780
MAI00790
MAI00800

```

```

C ED) ONTO THE LINKS OF THE NETWORK
C
C MODIFY ZONE ATTRIBUTIONS TO ACCOUNT FOR OVER CAPACITY DEMAND
  WRITE (6,28)
  28 FORMAT('TRAFFIC SUBMODEL',/0-----'//)
  3  N1 = NEXT +1
    DO 33 Z = 1, NZONES
      IF (Z .GT. NEXT) GO TO 32
      VZ(Z) = ZATTR(Z)/ZAT(1)*TOTGEN
      ZV(Z) = ZGENR(Z)/ZGT(1)*TOTATT
      GO TO 325
    32 VZ(Z) = ZATTR(Z)/ZAT(2)*TOTATT
      ZV(Z) = ZGENR(Z)/ZGT(2)*TOTGEN
    325 VTMULT(1) = (ZVT(2,Z) + ZVT(3,Z))/(ZVT(1,Z)+ZVT(2,Z)+ZVT(3,Z))
      VTMULT(2) = VTMULT(1)*ZV(Z)
      VTMULT(3) = VTMULT(1)*VZ(Z)
C STORE THE ZONE ATTRIBUTIONS AND GENERATION TEMPORARILY
      QUEUE(Z) = VTMULT(1)
      QUEUE(Z+50) = VTMULT(2)
      PRINT 935, VZ(Z), ZV(Z)
      VZ(Z) = VZ(Z) - VTMULT(1)
      ZV(Z) = ZV(Z) - VTMULT(2)
      PRINT 935, VZ(Z), ZV(Z)
    33 CONTINUE
    DO 352 J=1,NZONES
      IZFLG = 0
      DO 35 Z = N1, NZONES
        C TEST FOR OVER CAPACITY DEMAND
        IF ( VZ(Z) - ZV(Z) .LE. FLA(Z)/PD - PV (Z)) GO TO 35
        C FIND ZONE TO ROUTE VEHCLS WITH LARGST ATTRACTION AND NOT
        C OVER CAPACITY
        IZMAX = 0.0
        ZMAX = 0.0
        DO 34 IZ = N1, NZONES
          IF ( VZ(IZ)-ZV(IZ) .GE. FLA(IZ)/PD -PV(IZ)) GO TO 34
        C IDENTIFY THE ZONE ATTRACTING THE MOST TRIPS
        IF (IZMAX .GE. VZ(IZ)) GO TO 331
        IZMAX = VZ(IZ)
        IZ2 = IZ
      34 SEARCH FOR A COMMON LINK BETWEEN IZ AND Z.

```

```

331 DO 333 IZ3 = 1,12
    IF(2LINKS(IZ3,I2) .EQ. 0) GO TO 333
    DO 332 IZ4 = 1,12
        IF(2LINKS(IZ4,I2) .EQ. 0) GO TO 332
        IF(1AES(2LINKS(IZ3,I2)).EQ. 1ABS(2LINKS(IZ4,I2))) GO TO 335
    CONTINUE
332 CONTINUE
333 GO TO 34
335 IF(2MAX .GT. PLA(I2)/PD-PV(I2)-(VZ(I2)-2V(I2)))GO TO 34
    ZMAX = ( PLA(I2) / PD - FV(I2) - (VZ(I2) - 2V(I2)) )
    IZ1 = I2
334 CONTINUE
    IF(12MAX .EQ. 0.0) GO TO 353
    IF(12MAX .EQ. 0.0) IZ1 = IZ2
    VZC = PLA(I2)/PD - PV(I2) + 2V(I2)
    VZ(IZ1) = VZ(IZ1) + VZ(I2) - VZC
    VZ(I2) = VZC
    IF(VZC .GT. 0.0) IZFLG = 1
335 CONTINUE
    IF(12FLG .LE. 0) GO TO 353
332 CONTINUE
333 CONTINUE
C RESTORE BUS AND OTHER VEHICLES TO TRIP DEMANDS
DO 36 IZ = 1,NZONES
    VZ(IZ) = QUEUE(IZ) +VZ(I7)
    2V(I2) = QUEUE(I7+50) +2V(I2)
    PRINT 935, (VZ(I7),2V(I2),IZ = 1,NZONES)
C935 FORMAT(* ISMAP35* 10F10.5)
C
C ROUTE THE VEHICLES ONTO LINKS AND ADD TO COUNT ARRAY
39 CALL ROUTEV
    PRINT 932, (L,(COUNT(J,L),J=1,4),L=1,NLINK)
938 FORMAT (7H-COUNTS/5 (26H LINK THRU RT LT TERM )/5 (14.1X,4F5.0,
11X))
C CONVERT VZ AND 2V BACK TO AUTOMOBILE ATTRACTIONS AND GENERATIONS
DO 39 IZ = 1, NZONES
    VTMULT(2) = ZVT(1,I2)/(ZVT(1,I2) + ZVT(2,I2)+2VT(3,I2) )
    VZ(I2) = VZ(I2) *VTMULT(2)
    2V(I7) = 2V(I7) + VTMULT(2)
    DO 40 L = 1, NLINK

```

MAI01210
 MAI01220
 MAI01230
 MAI01240
 MAI01250
 MAI01260
 MAI01270
 MAI01280
 MAI01290
 MAI01300
 MAI01310
 MAI01320
 MAI01330
 MAI01340
 MAI01350
 MAI01360
 MAI01370
 MAI01380
 MAI01390
 MAI01400
 MAI01410
 MAI01420
 MAI01430
 MAI01440
 MAI01450
 MAI01460
 MAI01470
 MAI01480
 MAI01490
 MAI01500
 MAI01510
 MAI01520
 MAI01530
 MAI01540
 MAI01550
 MAI01560
 MAI01570
 MAI01580
 MAI01590
 MAI01600

```

DO 395 K=1,3
  TT(L,K)=0.0
  395 DELA(L,K)=0.0
  40 QUEUE(L) = 0.0
  C FIND DELAY AND QUEUE LENGTHS AT INTERSECTIONS
    DO 45 I=1,NINS
      IF (ITYPC(I) .GT. 0) GO TO 43
      CALL INSEC
      GO TO 45
    43 CALL INSEC
    45 CONTINUE
    DC 465 L=1,NLINK
  C DETERMINE AVERAGE QUEUE LENGTH IN FEET ON EACH LINK AT 30 FT/VEH.
    QUEUE(L) = QUEUE(L)*30./NLANE(L)
    QUEUE(L)=AMIN1(QUEUE(L),DIST(L))
    IF(VFL(L) .LE. 0) GO TO 465
  C MODIFY VELOCITY BASED ON A SIMPLE LINK MODEL
    SC = (COUNT(1,L)+COUNT(2,L)+COUNT(3,L))*3600/TP
    CAFL = 1200.
    IF(VEL(L) .GT. 70.0) CAFL = 1200.
    V = VEL(L)*(1.0-.5*SC/(NLANE(L)*CAFL))
    DC 46 K=1,3
  46 TT(L,K) = DIST(L)/V + DELA(L,K)
  465 CONTINUE
  47 CONTINUE
  C
  C FIND THE RUNNING TIMES IN THE PARKING ZONES
    P21 = NEXT +1
    DC 57 PZ=P21,NZONES
    CALL PARKING
    PRT(PZ)=TTP
    IF(NOPARK.EG.1) PRT(PZ)=1.0E-08
  57 CONTINUE
  C
  C WRITE OUT RESULTS
    WRITE (6, 961) (L,(TT(L,K),K=1,3),L =1,NLINK)
  961 FORMAT (1H0, 6(20HLINK TRAVEL TIMES )/(1X,6(I3,2X,3F5.0 )))
    SUMIT=0.0
    SVMT=C.0
    SDELA=0.0

```

MAI01610
 MAI01620
 MAI01630
 MAI01640
 MAI01650
 MAI01660
 MAI01670
 MAI01680
 MAI01690
 MAI01700
 MAI01710
 MAI01720
 MAI01730
 MAI01740
 MAI01750
 MAI01760
 MAI01770
 MAI01780
 MAI01790
 MAI01800
 MAI01810
 MAI01820
 MAI01830
 MAI01840
 MAI01850
 MAI01860
 MAI01870
 MAI01880
 MAI01890
 MAI01900
 MAI01910
 MAI01920
 MAI01930
 MAI01940
 MAI01950
 MAI01960
 MAI01970
 MAI01980
 MAI01990
 MAI02000

```

SNSTOP=0.0
SGI=0.0
SHT=0.0
DC 63 L=1,NLINK
DC 62 K=1,3
SUMIT = TT(L,K)*COUNT(K,L)/3600. + SUMIT
SVMT = COUNT(K,L)*DIST(L)/5280.0 + SVMT
SDELA = DELA(L,K)*COUNT(K,L)/3600.+SDELA
SNSTOP = NSTOPS(L) + SNSTOP
SGI = QUEUE(L) + SGI
DC 64 PZ = PZ1, NZONES
SFT = PRT(PZ)/3600. + SFT
PRINT 662, SUMIT, SHT, SVMT
662 FORMAT (29H-TOTAL TRAVEL TIME ON NETWORK, F21.0, 9H(VEH-HRS) /
1 36H TOTAL RUNNING TIME IN PARKING ZONES, F14.0, 9H(VEH-HRS)/
2 40H TOTAL VEHICLE MILES TRAVELLED ON NETWORK, F10.0, 9H(VEH-MI))
PRINT 663, SDELA, SNSTOP, SGI
663 FORMAT (36H-TOTAL INTERSECTION DELAY ON NETWORK, F14.0, 9H(VEH-HRS)/MAI02170
1 29H TOTAL STOPS AT INTERSECTIONS, F21.0, 5H(VEH)/MAI02180
2 44H TOTAL OF INTERSECTION AVERAGE QUEUE LENGTHS, F6.0, 5H(FT) )
IF (IST.GT. 1) GO TO 7
CALL COORXY
C
C EMISSIONS MODEL
C
7 CALL EMIT
C ADD EMISSIONS FROM 1 LINK ZONES TO THE APPROPRIATE LINK
IST = IST + 1
DO 75 JZ = 1, NZONES
IF(PNOS(IZ).NE. 1) GO TO 75
L = ZLINKS(1, IZ)
ADEMIS = PRT(IZ)/(DIST(L)*Q.3042)
DO 73 J=1,4
73 EMISS(L,J) = EMISS(L,J) + ADEMIS
75 CONTINUE
C APPLY TUNING FACTOR TO ALL EMISSIONS
DO 77 L=1,NLINK
DO 77 J=1,4
77 EMISS(L,J) = EMISS(L,J) * TUNFAC
C

```

MAI02010
MAI02020
MAI02030
MAI02040
MAI02050
MAI02060
MAI02070
MAI02080
MAI02090
MAI02100
MAI02110
MAI02120
MAI02130
MAI02140
MAI02150
MAI02160
MAI02170
MAI02180
MAI02190
MAI02200
MAI02210
MAI02220
MAI02230
MAI02240
MAI02250
MAI02260
MAI02270
MAI02280
MAI02290
MAI02300
MAI02310
MAI02320
MAI02330
MAI02340
MAI02350
MAI02360
MAI02370
MAI02380
MAI02390
MAI02400

AX A. ISMAP MODEL COMPUTER PROGRAM SOURCE CODE, ENVIRONMENTAL PROTECTION AGENCY

C C DISPERSION MODEL

C C CALL DISPER

C C PRINT RESULTS

C C CALL PRNTOU

DO 88 PZ = PZ1,NZONES

PV(PZ) = AMAX1(PV(PZ)+VZ(PZ) - ZV(PZ), 0.0)

GO TO 1

END

MAI02410
MAI02420
MAI02430
MAI02440
MAI02450
MAI02460
MAI02470
MAI02480
MAI02490
MAI02500

```

SUBROUTINE INPT
COMMON / COMM / I,Z,L,J,K,TOD,DOW,TP,TOTATT,ITPZ,TOTGEN,ITM
1,NYEAR,LHEAD(15),TUNFAC
INTEGER Z,VT
COMMON / LINK / NLINK,NLANE(200),X1(200),Y1(200),X2(200),Y2(200)
1),LCAP(200),DIST(200),VEL(200),LCON(200,3)
2,NSTOPS(200)
COMMON / INTRST / NINS,LIN(70,4),ITYPE(70),ICYCL(70),PH(70,4),
1 CI(70),GCAP(70,4),GUE(70,4)
COMMON / ZONES / NZONES,NZLINK(50),ZLINKS(12,50),ZATTR(50),
1ZGENR(50),NEXT,ZAT(2),ZGT(2),ZVT(3,50),ZNAME(50)
INTEGER ZNAME
INTEGER ZLINKS
COMMON / GATE / NGATE,LGATE(2,10),VCR(10,2,4)
COMMON / VOLUME / COUNT(4,200)
COMMON / PARK / PZ,PV(50),PLA(50),VZ(50),ZV(50),PD,PLS,PLEO
1,FNOS(50),PLL(50)
INTEGER PNO5
COMMON / VEHTYP / VT,VTP(3),VIE(3),VMULT(2),SZVTP(3,2)
COMMON / DISP / X0(200),Y0(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
1,YEXP(24),YCONSL,YCONS2,YCOEFF(24),ZEXP(24),ZCONST,GRDSI7,BCYG
2,D,MIX,ISTAT(24),SLAT,ICLD(24),NMET,NV,ITIME,HEIGHT(200)
COMMON / EXCLUD / NOPARK
COMMON / STCAN / ISTR(200),AST(200),NLKST(200),WST(200),
&BUILDH(200),RECHGT(200),JSTLIN(200,2),JRSIDE(200)
COMMON / JUNK1 / AC,XLOAD(3),TRAILR,ABSHUM
COMMON / INCOM / ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2
COMMON / JUNK2 / HGWGT,HDWGT,HGCID,HDCID
COMMON / ELINK / IREG,TEMP,COLD,HOT,CCOLD,VMTMIX(6),
8 ALHFLG,TRKFLG,IMFLG
INTEGER ALHFLG,TPKFLG
READ(5,910,END=90)NYFAR,LHEAD,NOPARK
c10 FORMAT(I6,15A4,T90,I1)
PRINT 911,NYEAR,LHEAD,NOPARK
911 FORMAT(IH1,20X,I10,5X,15A4,I4)
IF(NOPARK.EQ.1)WRITE(6,915)
915 FORMAT(/,1X,'PARKING LOT EMISSIONS NOT CONSIDERED')
READ(5,912,END=90)IC,L,I,Z,ICN,IC,NV,KT,NR,NMET,TOD,DOW,TP,
1TOTATT,TOTGEN,PD,ITM
PRINT 912,IC,L,I,Z,ICN,IC,NV,KT,NR,NMET,TOD,DOW,TP,TOTATT,TOTGEN,PINP00400
INP00010
INP00020
INP00030
INP00040
INP00050
INP00060
INP00070
INP00080
INP00090
INP00100
INP00110
INP00120
INP00130
INP00140
INP00150
INP00160
INP00170
INP00180
INP00190
INP00200
INP00210
INP00220
INP00230
INP00240
INP00250
INP00260
INP00270
INP00280
INP00290
INP00300
INP00310
INP00320
INP00330
INP00340
INP00350
INP00360
INP00370
INP00380
INP00390
INP00400

```

```

1D,ITM
912 FORMAT(I2,I3,I5,6F5.0,1F)
   IF(NOPARK.EQ.1) PD=1.0E-5
2   IF(L.EQ.0) GO TO 3
   NLINK = L
   DO 25 L1=1,NLINK
     READ(5,922) IC, L, (NLANK(L), X1(L), Y1(L), X2(L), Y2(L), LCAP(L)
1,VEL(L),LCON(L,J),J=1,3),HEIGHT(L))
25   PRINT 922,IC, L, (NLANK(L), X1(L), Y1(L), X2(L), Y2(L), LCAP(L),VEL
1(L),LCON(L,J),J=1,3),HEIGHT(L))
922 FORMAT(I2,I3,I5,4F5.0,I5,F5.0,3I5,F5.0)
3   IF(I.FQ.0) GO TO 4
   NINS = I
   READ(5,973) (IC,I,(LIN(I,J),J=1,4),ITYPE(I),ICYCL(I),(PH(I,K)
1, K=1,4),CI(I),(CCAP(I,M),M=1,4),I1=1,NINS)
   PRINT 932, (IC,I,(LIN(I,J),J=1,4),ITYPE(I),ICYCL(I),(PH(I,K)
1, K=1,4),CI(I),(CCAP(I,M),M=1,4),I1=1,NINS)
932 FORMAT(I2,I3,I5,6I5,9F4.0)
4   IF(2.FQ.0) GO TO 5
   NZONES = Z
   I=1
   IZ=NZONES
   DO 475 KZ = 1,NZONES
     READ(5,944) (IC,ICYT, ZATTP(I2),ZGENP(I2),(ZVT(J,17),J=1,3),
1OVER,PLC,NEL, (ZLINKS(K,17),K=1,12))
     IF(IC.NE.4) CALL EXIT
944 FORMAT(I2,I2,2F3.0,2I3,1,2F5.0,I2,12I4)
   C THIS TEST IS PECULIAR TO THE CDC 6400 COLLATING SEQUENCE.
   IF (TEXT.GT.49) GO TO 44
   C STORE AN INTERNAL ZONES DATA
   JZ = IZ
   IZ = IZ - 1
   GO TO 47
   C STORE AN EXTERNAL ZONES DATA
44   NEXT = Z
   ZATTP(2) = ZATTP(I2)
   ZGENP(2) = ZGENP(I2)
   ZVTSUM = 0.0
   DO 45 K=1,12
45   ZLINKS(K,2) = ZLINKS(K,12)

```

COMPUTER PROGRAM SOURCE CODE

ISMAP MODEL

APPENDIX A.

```

46      DO 46 J = 1,3
         ZVT(J, Z) = ZVT(J, IZ)
         JZ = Z
         Z = Z+1
47      DO 472 K=1,12
         IF (ZLINKS(K,JZ) .NE. 0) GO TO 472
         NZLINK (JZ) = K-1
         GO TO 473
475     CONTINUE
         NZLINK(JZ) = 12
         IF (PLC .NE. 0.0) PLA(JZ) = PLC*PD
         IF (PVEH .NE. 0.0) PV(JZ) = PVEH
         PNOS(JZ) = NZL
         ZNAME(JZ) = IEXT
         IF (ZVT(1,JZ) + ZVT(2,JZ) + ZVT(3,JZ) .LF. 0.) ZVT(1,JZ) = 1.0
         CONTINUE
         ZAT(1)=0.0
         ZAT(2)=0.0
         ZGT(1)=0.0
         ZGT(2)=0.0
         DO 49 Z = 1,NZONES
            IZ = Z
            KZ = NZLINK(IZ)
            IF (Z .GT. NEXT) GO TO 49
            ZAT(1) = ZAT(1) + ZATTR(Z)
            ZGT(1) = ZGT(1) + ZGENR(Z)
            GO TO 49
            ZAT(2) = ZAT(2) + ZATTR(Z)
            ZGT(2) = ZGT(2) + ZGENR(Z)
            PRINT 944, IC, ZNAME(IZ), ZATTR(IZ), ZLINKS(K,IZ), K=1,KZ
            1. PV(IZ), PLA(IZ), PNOS(IZ)
            IF (ICN .EQ. 0) GO TO 6
            READ(5,955) IC,GRDSIZ,BCKGRD,SLAT,TUNFAC,ZCONST,I REG,TEMP,
            1 COLD,HOT,CCOLD,(VMTMIX(J1),J1=1,6),ALHFLG,TPKFLG,IMFLG
            055 FORMAT(12,5F4.0,12,F4.0,2F5.3,1X,3I1)
            IF (TUNFAC.EQ.0) TUNFAC=1
            WRITE(6,955) IC,GRDSIZ,BCKGRD,SLAT,TUNFAC,ZCONST,I REG,TEMP,
            1 COLD,HOT,CCOLD,(VMTMIX(J1),J1=1,6),ALHFLG,TPKFLG,IMFLG
            IF (ALHFLG.EQ.1) READ(5,956) AC,(XLOAD(J1),J1=1,3),TPAILR,ABSHUM
            956 FORMAT(10X,6F10.0)

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```

IF (ALHFLG.EQ.1) WRITE(6,55)AC, (XLOAD(J1),J1=1,3),TRAILR,AEASHUM
IF (TRKFLG.EQ.1) READ(5,956)HGWGT,HDWGT,HGCID,HDCID
IF (TRKFLG.EQ.1) WRITE(6,956)HGWGT,HDWGT,HGCID,HDCID
IF (IMFLG.EQ.1) READ(5,957)ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2
IF (IMFLG.EQ.1) WRITE(6,957)ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2
057 FORMAT(10X,515)
6 IF (IG.EQ.0) GO TO 7
NGATE = IG
READ(5,966) (IC, (LGATE(J,IG),J =1,2),IG=1,NGATE )
PRINT 966,(IC, (LGATE(J,IG),J =1,2),IG=1,NGATE )
966 FORMAT ( 12, 3X, 215)
7 IF (NV.EQ.0) GO TO 76
NVEIP = NV
READ(5,97) (IC, VT, VIP(VI), VTE(VI),K=1,NV)
FORMAT (12,13, 2F5.3)
76 CONTINUE
8 IF (KT.EQ.0) GO TO 89
NCOUNT = KT
DO 85 K=1,NCOUNT
READ(5,988) IC,L,(COUNT(J1,L),J1=1,3), L2,(COUNT(J2,L2),J2=1,3),
1 L3,(COUNT(J3,L3),J3=1,3), L4,(COUNT(J4,L4),J4=1,3)
PRINT 988,IC,L,(COUNT(J1,L),J1=1,3), L2,(COUNT(J2,L2),J2=1,3),
1 L3,(COUNT(J3,L3),J3=1,3), L4,(COUNT(J4,L4),J4=1,3)
988 FORMAT ( 12,13, 7F5.0), 3(15, 7(F5.0))
80 IF (NR.LE.0) GO TO 8910
NUMREC = NR
DO 90 I=1,NR
DO 9010 J=1,2
ISTRIN(I,J)=0
0010 CONTINUE
READ(5,989)IC,XO(I),YO(I),ISTR(I),AST(I),NLDUM,WST(I),
8 BUILDH(I),RECHGT(I),ISTRIN(I,1),ISTRIN(I,2),IRSIDE(I)
FORMAT(12,2F10.5,13,F5.0,15,2F10.0,F5.0,213,14)
989 NLRST(I)=NLDUM
XO(I)=XO(I)+0.3048
YO(I)=YO(I)+0.3048
WST(I)=WST(I)+0.3048
BUILDH(I)=BUILDH(I)+0.3048
90 RECHGT(I)=RECHGT(I)+0.3048
IF (IC.NE.9) PRINT 9991

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```

9891 FORMAT(1X, ' CARD TYPE 9 CHECK ERROR ')
DO 9893 I=1,NR
PRINT 9892, IC, XC(I), YD(I), ISTR(I), AST(I), NLKST(I),
&WST(I), BUILDH(I), RECHGT(I), ISTRIN(I,1), ISTRIN(I,2), IRSIDE(I)
9892 FORMAT(1X, I2, 2F10.5, I3, F5.0, I5, 2F10.0, F5.0, 2I3, I4)
9893 CONTINUE
8910 IF(NMET.EQ.0.AND.IMET.EQ.24) GO TO 98
IF(NMET.EQ.0.AND.IMET.EQ.1) CALL EXIT
IMET=NMET
IF(NMET.EQ.1) GO TO 9901
DO 9899 I=1,24
READ(5,9899) IC, THETA(I), WS(I), ICLO(I)
FORMAT(12, 2F8.2, I5, F7.2, 2F10.2)
9899 WRITE(6,9897) IC, THETA(I), WS(I), ICLO(I)
9897 FORMAT(1X, I2, 2F8.2, I5, F7.2, 2F10.2)
GO TO 98
9901 ITIME=I0D+1
READ(5,9899) IC, THETA(ITIME), WS(ITIME), ISTAR(ITIME)
PRINT 9897, IC, THETA(ITIME), WS(ITIME), ISTAR(ITIME)
98 RETURN
99 STOP
END
INP01610
INP01620
INP01630
INP01640
INP01650
INP01660
INP01670
INP01680
INP01690
INP01700
INP01710
INP01720
INP01730
INP01740
INP01750
INP01760
INP01770
INP01780
INP01790
INP01800
INP01810
INP01820

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C SUEROUTINE INSEC
C THIS PROGRAM COMPUTES DELAY AND QUEUE LENGTH AT AN INTERSECTION.
C IT IS BASED ON GORDON NEWELLS INTERSECTION MODEL. THREE TYPES OF
C SIGNALS MAY BE SPECIFIED 1)FIXED TIME 2)ACTUATED WITH LEFT TURN
C PHASES 3)ACTUATED WITH SEPERATE PHASES FOR EACH APPROACH. THIS MODEL
C WILL HANDLE OVER CAPACITY INTERSECTIONS, AN EXTENSION TO NEWELLS
C MODEL. BY ASSUMING CAPACITY FLOW WHEN THE QUEUE LENGTH AT THE END
C OF GREEN EQUALS HALF THE ARRIVALS ON RED PLUS THE ARRIVALS ON GREEN
C CYCLE AND PHASE
C LENGTHS ARE COMPUTED BASED ON F.V.WEBSTER "TRAFFIC SIGNAL SETTINGS"
COMMON / COMM/ I,Z,L,J. K. TOD. DOW, TP. TOTATT, TTPZ,TOTGEN
COMMON /LINK/ NLINK, NLANE(200), X1(200), Y1(200), X2(200), Y2(200)
1. LCAF(200), DIST(200), VEL(200), LCON (200,3)
2. NSTOPS(200)
COMMON /INTKST/NI, LIN(70,4), ITPC(70), ICYCL(70), PH(70,4), CI(70)
1. GCAP(70,4),QUE(70,4)
COMMON /ZONES/ NZONES,NZLINK(50), ZLINKS(12,50), ZATTP(50),
1ZGENR (50), NEXT, ZAT(2), ZGT(2), ZVT(3,50), ZNAME(50)
COMMON / GATE/ NCATE, LGATE(2,10), VCR(10, 2,4)
COMMON /VOLUME/ COUNT(4,200)
COMMON /PARKZ/ P7, FV(50), FLA(50), VZ(50), ZV(50)
REAL HINF
COMMON TT(200,3), DELA(200,3), PRT(50), QUEUE(200)
COMMON PT(4,3),VOL(4,3),Y(4,3),CAP(4,3),YI(4)
1.DELAI(70,8),GG(4,3)
REAL*8 NPHASE(9)
DATA NPHASE/ PHNORTH-AP, 8H EAST-AP, 8HSOUTH-AP,
1 8H WEST-AP, 8HN-AP-LFT, 8HS-AP-LFT, 8HE-AP-LFT,
2 8HW-AP-LFT, 8H
C FOR EACH SIGNAL PHASE DETERMINE A PHASE LENGTH
1 NP = C
MINR = 1.0
SY = 0
C INITIALIZE VOLUMES ON EACH APPROACH
DO 15 J=1,4
VOL(J,1) = 0.0
L = LIN(I,J)
IF(L.GT.0) VOL(J,1)=(COUNT(3,L)+COUNT(2,L)+COUNT(1,L))*3600./TP
VOL(J,2)=0.0
VOL(J,3)=0.0

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```

CAP(J,2)=0.0
CAP(J,3)=0.0
DELA(I,J)=0.0
DELA(I,J+4)=0.0
QQ(J,1)=0.0
QQ(J,2)=0.0
QQ(J,3)=0.0
15 CONTINUE
C FIRST DETERMINE THE VOLUME AND CAPACITY OF EACH APPROACH.
2 J1 = 1
C J IS INDEX OF APPROACH DIRECTION
C J2 IS INDEX OF PHASE CONTROLLING THIS APPROACH
DO 25 J = 1,4
CAP(J,1) = 0.5
L = LIN(I,J)
IF(L.EQ.0) GO TO 24
C SET J1-AN INDEX TO TEST WHETHER THERE IS MORE THAN ONE PHASE (OR
C SUB-PHASE CONTROLLING THE N-S OR E-W APPROACHES
J2 = J1
C SET INDEX J3 TO IDENTIFY OPPOSING TRAFFIC
C IE OPPOSING APPROACH
J3 = J1
IF(J.LE.2) J3 = J+2
IF(ITYPC(I).EQ.3) GO TO 21
IF(ITYPC(I).EQ.4.AND.J1.EQ.2) GO TO 21
IF(ITYPC(I).EQ.5.AND.J1.EQ.1) GO TO 21
CAP(J,1) = GCAP(I,J2)
IF(CAP(J,1).EQ.0.0) CAP(J,1) = NLANE(L)*1200.
IF(VOL(J,1).LE.0.) GO TO 24
C CONTROL IS BY A TWO PHASE SIGNAL WITH 2 POSSIBLE MINOR MOVEMENTS
IF(PH(I,J2+2).NE.0.) GO TO 22
IF(VOL(J,1).EQ.0.0) GO TO 225
C MODIFY THE CAPACITIES DUE TO LEFT TURNING VEHICLES (SEE TABLE 6.5 HCM)
200 PCNTRN = AMIN1(COUNT(3,L)/VOL(J,1)+3600./TP,0.3)
BASEPT = 0.1
DIF = 0.5
BPVAL = 0.0
IF(NLANE(L).GT.2) GO TO 208
IF(NLANE(L).EQ.2) GO TO 205
IF(PCNTRN.LT.0.2) GO TO 201

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INS00410
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INS00690
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INS00780
INS00790
INS00800

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BASEPT = 0.2
BPVAL = 0.15
GO TO 205
201 IF(PCNTRN .LT. 0.15) GO TO 203
BASEPT = 0.15
BPVAL = 0.1
GO TO 207
203 DIF = 2.0
IF(PCNTRN .LT. 0.1) DIF = 3.0
GO TO 208
205 IF(PCNTRN .LT. 0.2) GO TO 207
BASEPT = 0.2
BPVAL = 0.1
GO TO 208
207 DIF = 1.0
208 FACL = DIF*(BASEPT-PCNTRN)-BPVAL
GO TO 23
C CAPACITY IS IDENTICAL FOR ALL THREE TURNING MOVEMENTS OF APPROACH
21 J2 = J
CAP(J,1) = GCAP(I,J2)
IF(CAP(J,1) .EQ. 0.0) CAP(J,1) = NLANE(L)*1200.
IF(VOL(J,1) .LE. 0.) GO TO 24
GO TO 225
22 VOL(J,1) = (COUNT(2,L) + COUNT(1,L)) * 3600./TP
VOL(J,3) = COUNT(3,L) * 3600./TP
C ASSUME A LEFT TURN CHANNEL THAT STORES ALL THE LEFT TURNING
C VEHICLES UNTIL THE LEFT TURN PHASE BEGINS.
CAP(J,1) = CAP(J,1) * (1.0 + 0.3/ NLANE(L))
CAP(J,3) = GCAP(I,J1+2)
IF(CAP(J,3) .LE. 0.) CAP(J,3) = 1200.
Y(J,2) = VOL(J,3)/ CAP(J,3)
225 FACL = 0.3/NLANE(L)
C MODIFY THE CAPACITIES DUE TO VARIATIONS IN RIGHT TURNING VEHICLES
23 FACR = 2.0
IF(VOL(J,1) .LE. 0.0) GO TO 24
PCNTRN = AMIN1(COUNT(2,L)/VOL(J,1) + 3600./TP, 0.3)
IF(PCNTRN .GT. 0.1) FACR = 1.0
IF(NLANE(L) .EQ. 2) FACR = 0.5
IF(NLANE(L) .GT. 2) FACR = 0.25

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INSO0810
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 INSO0980
 INSO0990
 INSO1000
 INSO1010
 INSO1020
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 INSO1050
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 INSO1070
 INSO1080
 INSO1090
 INSO1100
 INSO1110
 INSO1120
 INSO1130
 INSO1140
 INSO1150
 INSO1160
 INSO1170
 INSO1180
 INSO1190
 INSO1200

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      FACK = (0.1-PCNTRN)*FACK
      IF (NLAHE(L) .EQ. 1 .AND. PCNTRN .GT. 0.2) FACK = FACK-(PCNTRN
1-G.2)/2.0
      CAP(J,1) = CAP(J,1) * (1.0+FACK+FACL)
C   COMPUTE WEBSTERS HIGHEST RATIO OF FLOW TO SATURATION FLOW FOR EACH
C   PHASE
24   Y(J,1) = 0.0
      IF ( CAP(J,1).GT.0.0 ) Y(J,1) = VOL(J,1)/ CAP(J,1)
25   J1 = 3-J1
C
C   CALCULATE THE MAXIMUM Y FOR EACH PHASE
      YT(3) = Y(3,1)
      YT(1) = Y(1,1)
      IF (ITYPC(I) .EQ. 3 .OR. ITPC(I) .EQ. 5) GO TO 26
      YT(1) = AMAX1 (Y(1,1),Y(3,1))
      YT(3) = 0.0
      IF ( PH(I,3) .NE. 0.) YT(3)=AMAX1 ( Y(3,3), Y(1,3))
26   YT(4) = Y(4,1)
      YT(2) = Y(2,1)
      IF (ITYPC(I) .EQ. 3 .OR. ITPC(I) .EQ. 4) GO TO 27
      YT(2) = AMAX1 (Y(2,1),Y(4,1))
      YT(4) = 0.0
      IF ( PH(I,4) .NE. 0.0) YT(4)= AMAX1( Y(2,3), Y(4,3))
27   DO 28 J=1,4
28   PT(J,1) = PH(I,J)
      COT = ICYCL(I)
      IF (ITYPC(I) .EQ. 1) GO TO 40
C   CALCULATE THE CONTROLLING Y RATIO TO PHASE TIME RATIO
      DO 29 J=1,4
      IF (PH(I,J).EQ.0) GO TO 29
      IF (YT(J) .LE. 0.0) GO TO 29
      SY = YT(J) + SY
      MINR = AMIN1( MINR, YT(J)/PH(I,J))
      NP= NP + 1
29   CONTINUE
C   CALCULATE A CYCLE TIME CO
      CO = 0.0
      DO 31 J=1,4
      PT (J) =YT(J)/MINR
31   CO = CO + YT(J)/MINR

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COMPUTER PROGRAM SOURCE CODE.

ISMAP MODEL

IX A.

```

C CALCULATE WEBSTERS OPTIMUM CYCLE TIME
COT = ICYCL(I)
IF(SY .LT. 1.0) COT = (1.5*CI(I)*NP + 5.0) / (1.0-SY)
IF(CO .GT. COT) GO TO 34
IF(CO .GT. ICYCL(I)) GO TO 33
IF(COT .GT. ICYCL(I)) GO TO 33
GO TO 343
33 CO = ICYCL(I)
GO TO 35
34 IF (COT.GT.ICYCL(I)) GO TO 33
343 CO = COT
35 COT = CO
SPT = 0.0
SPH = 0.0
C FIND THE PHASE TIMES FOR THIS CYCLE LENGTH
DO 37 J=1,4
  IF(PH(I,J) .LE. 0.0) GO TO 37
  PT(J,1) = YT(J)/CY+COT
  IF(PT(J,1) .GT. PH(I,J)) GO TO 36
  C PHASE SKIPABILITY IS ASSUMED FOR CONTROLLER.
  IF(PT(J,1) .LE. 0.0) GO TO 37
  SPH = SPH + PH(I,J)
  PT(J,1) = PH(I,J)
  GO TO 37
36 SPT = PT(J,1) + SPT
37 CONTINUE
  IF(SPT + SPH .LE. COT) GO TO 40
  COT = SPT + SPH
  IF(COT .LE. ICYCL(I)) GO TO 40
  C REDISTRIBUTE TIME BEYOND PHASE TIME.
  RDIS = COT - ICYCL(I)
  COT = ICYCL(I)
  DO 39 J=1,4
    C PHASE MIGHT BE 0.0 , EQUAL OR GREATER THAN PH(I,J)
    IF(PT(J,1) .LE. PH(I,J)) GO TO 39
    PTJ = PT(J,1)
    PT(J,1) = PT(J,1) + (1.0-RDIS/SPT)
    IF(PT(J,1) .LT. PH(I,J)) PT(J,1) = PH(I,J)
    SPT = SPT - PTJ
    RDIS = RDIS - PTJ + PT(J,1)

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INSO1610
 INSO1620
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 INSO1940
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 INSO1980
 INSO1990
 INSO2000


```

30 CONTINUE
C
C COMPUTE DELAY, QUEUE LENGTH, NSTOPS
C SET J1, A PHASE INDEX, J1 = 1,2,1,2 WHEN J = 1,2,3,4 AND ITPC = 1
40 J1 = 1
DO 63 J=1,4
NS = 0
W1 = 0.0
W2 = 0.0
W3 = 0.0
Q1 = 0.0
L = LIN(I,J)
IF(L.LE.0) GO TO 63
DO 61 K=1,3
IF(K.EQ.2) GO TO 60
C DETERMINE THE PHASE INDEX J2 OF THIS APPROACH AND TURNING MOVEMENT.
IF(ITPC(I).LT.3) GO TO 43
IF(ITPC(I).EQ.4.AND.J1.EQ.1) GO TO 43
IF(ITPC(I).EQ.5.AND.J1.EQ.2) GO TO 43
IF(K.EQ.3) GO TO 60
J2 = J
GO TO 44
43 J2 = J1 + K-1
44 IF(PT(J2,1).EQ.0.0.AND.K.EQ.3) GO TO 60
C MODIFY CAPACITY PER HOUR OF GREEN TO CAPACITY PER HOUR
CAP(J,K) = CAP(J,K)*(PT(J2,1)-CI(I) / 2.0)/COT
CAP(J,K) = AMAX1(0.0, CAP(J,K))
C TEST THAT THE VOLUME DOES NOT EQUAL CAPACITY. CAPACITY IS DEVALUED
GREENQ = 0.0
IF(PT(J2,1).GT.0.0) GREENQ = 3600./((COT + PT(J2,1))
IF(VOL(J,K) + GREENQ .GE.
CAP(J,K)) GO TO 50
C COMPUTE QUEUE LENGTH AT END OF GREEN
W1 = (COT-PT(J2,1))*2/(2.0*COT*(1.-Y(J,K)))
Q0 = VOL(J,K)/(2.0*(CAP(J,K) - VOL(J,K)))
IF(K.GT.1) GO TO 54
C W1 IS THE DELAY DUE TO RESIDUAL QUEUE FROM PREVIOUS TIME PERIOD
IF(VOL(J,1).GE.0.0) GO TO 52
W3 = QUE(I,J)+QUE(1,J)/((CAP(J,1) -VOL(J,1))*2.0*VOL(J,1)) *360
GO TO 52
50 IF(GREENQ.GT.1.0)

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IX A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE.

ENVIRONMENTAL PROTECTION AGENCY

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1  GO = CAP(J,K)*(GREENQ*2.0 - 1.0 + AMIN1(VOL(J,K)-CAP(J,K),0.0))
2  /((2.0*GREENQ*(GREENQ-1.0))- 0.5)
   K1 = (COT - PT(J,1))/2.0
   IF(VOL(J,K).GT.CAP(J,K))
101  = AMAX1(0.0, (VOL(J,K) - CAP(J,K))*TP/3600.
1  + AMAX1(0.0,QUE(I,J) - Q0) )
   IF(K.GT.1) Q1 = AMAX1(0.0, (VOL(J,K)-CAP(J,K))*TP/3600.)
   IF(Q1.GT.0.0) W3 = TP
   IF(CAP(J,K).GT.0.0) W3 = Q1*1800./CAP(J,K)
52  Q0 = Q0 + Q1
54  W2 = 60*1800.
   IF(CAP(J,K).NE.0.) W2 = 90*3600./CAP(J,K)
   NS = (1.0-PT(J2,1))/COT/(1.0-Y(J,K))*VOL(J,K)*TP/3600. + NS
C  COMPUTE INVERTED VOLUME TO CAPACITY RATIOS AT EACH GATE
DO 56  IG = 1,NGATE
   K1 = 1
   IF ( L .EQ. LGATE(1,IG))GO TO 57
   K1 = 2
   IF ( LCON (L, K) .EQ. LGATE(2,IG)) GO TO 57
54  CONTINUE
   GO TO 60
57  VCR (IG,K1, K) = 0.0
   IF(VOL(J,1).NE.0.0) VCR(IG,K1,K) = CAP(J,1)/VOL(J,1)
   IF (VOL(J, K) .NE. 0.0) VCR(IG,K1,K) = CAP(J,K) / VOL(J,K)
60  DELA(L,K) = W1 + W2 + W3
   Q0(J,K) = Q0
   IF (K.GT.1) GO TO 61
C  COMPUTE THE AVERAGE QUEUE LENGTH FOR A SIGNAL CYCLE.
C  QUEUE AT END OF GREEN + AVERAGE QUEUE DURING RED PHASE
   QQUE(L) = Q0 + W1*VOL(J,1)/3600.
   Q0 = 0.0
61  CONTINUE
   QQUE(L) = QQUE(L) + Q0
   NSTOPS(L) = NS
C  MOVE LEFT TURNING Q AND VOL FOR PRINTING PURPOSES
   Q(J,2) = Q(J,3)
   VOL(J,2) = VOL(J,3)
   CAP(J,2) = CAP(J,3)
   Y(J,2) = Y(J,3)
   QUE(I,J) = Q0(J,1) + Q0(J,2)

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62      DELAI(I,J) = DELA(L,1)
        DELAI(I,J+4) = DELA(L,3)
        J1 = 3-J1
        GG(9,1)=0.0
        VCL(9,1)=0.0
        CAP(9,1)=0.0
        Y(9,1)=0.0
        PRINT 9631, I,(J,J=1,4)
9631    FORMAT (13H0INTERSECTION I5/ 4(23X,5HPHASE,I2))
        PRINT 9632, (PT(J,1),J=1,4)
9632    FORMAT (5H TIME, 4(1PX,F4.0,8X))
        PRINT 9633, (YT(J),J=1,4)
9633    FORMAT (5H V/GC, 4(18X,F7.5,5X))
        IF(ITYPC(I) .GT. 2) GO TO 6331
        I2=3
        I4=4
        I5=5
        I6=6
        I7=7
        I8=8
        I9=9
        I10=6
        GO TO 6335
6331    IF(ITYPC(I) .GT. 3) GO TO 6332
        I2=9
        I4=9
        I6=9
        I8=9
        I5=3
        I7=4
        I9=9
        I10=4
        GO TO 6335
6332    IF(ITYPC(I) .GT. 4) GO TO 6333
        I2=3
        I4=9
        I8=9
        I5=5
        I6=6
        I7=4

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INS02810
INS02820
INS02830
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INS02870
INS02880
INS02890
INS02900
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INS02940
INS02950
INS02960
INS02970
INS02980
INS02990
INS03000
INS03010
INS03020
INS03030
INS03040
INS03050
INS03060
INS03070
INS03080
INS03090
INS03100
INS03110
INS03120
INS03130
INS03140
INS03150
INS03160
INS03170
INS03180
INS03190
INS03200

```

```

15=7
110=4
GO TO 6335
6333 CONTINUE
12=5
16=9
14=4
15=3
17=7
18=8
19=9
110=6
6335 PRINT 96335, NPHASE(1), NPHASE(I2), NPHASE(2), NPHASE(I4), NPHASE(I5)
1, NPHASE(I6), NPHASE(I7), NPHASE(I5)
96335 FORMAT(5X,4(7X,A0,7X,A0,4X))
PRINT 9634, (DELA(I,J), DELAI(I,J+2), J=1,2), DELAI(I,I5), DELAI(I,I9)
1, DELAI(I,I10), DELAI(I,I6)
9634 FORMAT(5H DELA, 4(5X,2F10.0,5X))
PRINT 9635, (QQ(J,1), QQ(J+2,1), J=1,2), QQ(I5,1), QQ(I9,1),
1QQ(I10,1), QQ(I8,1)
9635 FORMAT(6H QUEUE 4(4X,2F10.0,6X))
PRINT 9636, (VOL(J,1), VOL(J+2,1), J=1,2), VOL(I5,1), VOL(I9,1),
1VOL(I10,1), VOL(I8,1)
9636 FORMAT(7H VOLUME 4(3X,2F10.0,7X))
PRINT 9637, (CAP(J,1), CAP(J+2,1), J=1,2), CAP(I5,1), CAP(I9,1),
1CAP(I10,1), CAP(I8,1)
9637 FORMAT(9H CAPACITY 4(1X,2F10.0,9X))
PRINT 9638, (Y(J,1), Y(J+2,1), J=1,2), Y(I5,1), Y(I9,1), Y(I10,1),
1,Y(I8,1)
9638 FORMAT(7H V/GCAP 4(7X,2F10.5,7X))
GO TO 50
90 CONTINUE
RETURN
END

```

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```

SUBROUTINE INSECU
COMMON / COMN / I,Z,L,J, K, TOL, DOW, TP, TOTATT, TTPZ, TOTGEN
COMMON / LINK / NLINK, NLANE(200), X1(200), Y1(200), X2(200), Y2(200)
1, LCAP(200), DIST(200), VEL(200), LCON(200,3)
2, NSTOPS(200)
COMMON / INTRST / NI, LIN(70,4), ITPC(70), ICYCL(70), PH(70,4), CI(70)
1, GCAP(70,4), QUE(70,4)
COMMON / ZONES / NZONES, NZLINK(50), ZLINKS(12,50), ZATTR(50),
1ZGENR(50), NEXT, ZAT(2), ZVT(2), ZVT(3,50), ZNAME(50)
COMMON / GATE / NGATE, LGATE(2,10), VCR(10, 2,4)
COMMON / VOLUME / COUNT(4,200)
COMMON / PARK / PZ, PV(50), FLA(50), V7(50), ZV(50)
COMMON TT(200,3), DELA(200,3), PRT(50), QUEUE(200)
COMMON PT(4,3), VOL(4,3), Y(4,3), CAP(4,3), Y1(4)
1, DELAI(70,4)
DIMENSION W(2), V(2)
INTEGER W

C
C UNSIGNALIZED INTERSECTIONS ARE HANDLED IN THIS SECTION
C NOTE THAT THE HCM RECOMMENDS, IN THE ABSENCE OF A BETTER ALTERNATIVE,
C TREATING AN UNCONTROLLED INTERSECTION AS A TYPE 2 SIGNALIZED INTERSECTION.
C TION. ACTUALLY INSECU IS MOST ACCURATE IN TREATING A 4 WAY STOP
C BUT CAN USUALLY BE USED FOR ANY UNSIGNALIZED INTERSECTION.
SLANE = 0.0
ALSV = 0.0
SVOL = 0.0
SCAP = 0.0
I4 = 0
J1 = 1
W(1) = 0.0
W(2) = 0.0
V(1) = 0.0
V(2) = 0.0
J2 = 1
DO 73 J = 1,4
C SUM THE VOLUME AND VOLUME DIFFERENCE FOR VEHICLES ON N-S AND E-W APPRACHES
L = LIN(I,J)
VOL(J,1) = 0.0
IF (L.LE. 0) GO TO 73
DELA(L,1) = 0.0

```

```

14 = I4 + 1
VOL(J,1) = (COUNT(1,L) + COUNT(2,L) + COUNT(3,L)) * 3600. / IP
IF(VOL(J,1) .GE. VOL(J1,1)) J1 = J
IF(ITYPEC(I) .GE. -1) GO TO 715
SVOL = SVOL + VOL(J,1)
ALSV = VOL(J,1) - ABSV
IF ( GCAP(I,J) .GT. 0) GO TO 727
IF ( NLANE(L) - 1) 71, 723, 725
71 STOP 1
715 V(J2) = AMAX1(VOL(J,1),V(J2))
W(J2) = MAX0(NLANE(L),W(J2))
IF(GCAP(I,J) .LE. 0.0) GCAP(I,J) = 1800. * NLANE(L)
GO TO 726
723 GCAP(I,J) = 475.
GO TO 727
725 GCAP(I,J) = 450. * NLANE(L)
C SUM THE CAPACITIES FOR ALL APPROACH LEGS
727 SCAP = SCAP + GCAP(I, J)
729 SLANE = SLANE + NLANE(L)
73 J4 = 3-J2
J1 = MOD(J1 + 2)
IF(ITYPEC(I) .GE. -1) GO TO 735
ALSV = ABS(APSV)
C COMPUTE A MODIFIED INTERSECTION CAPACITY BASED ON VOLUME SPLIT
C FROM HCM TABLE 6.2 )
IF(SVOL .GT. 0.0)
1SNCAP = SCAP * AMAX1(1.0 - ABSV/SVOL/1.9, .816)
IF (I4 .LT. 4) SNCAP = SCAP
GO TO 738
735 IF(V(1) .LT. 1.0 .OR. V(2) .LT. 1.0) GO TO 736
P = V(1)/V(2)*W(2)/W(1)
SNCAP = 1800. * (W(1)*R+W(2))/(R+1.0)
SVOL = V(1) + V(2)
C COULD INCLUDE MODIFICATION TO GCAP AT A 2 WAY STOP BASED ON GAP ACCEPTANCE
738 CONTINUE
C COMPUTE NEW CAPACITIES FOR EACH APPROACH
IG = 0
IC1 = 0
DO 77 J = 1,4
L = LIN(I,J)

```

```

DLLAI(I,J) = 0.0
DO = 0.0
IF(L .LE. 0) GO TO 767
NSTOPS(L) = 0
IF(SVOL .LE. 0.) GO TO 76
CAP(J,1) = VOL(J,1)*SNCAP/SVOL
C TEST IF OVER CAPACITY DEMAND
DO = AMIN1(VOL(J,1), (VOL(J,1) - CAP(J,1))*TP/3600.+QUE(I,J)+5.0)
IF(VOL(J,1) .LT. CAP(J,1)) GO = AMIN1(5.0,1.0/(SNCAP/SVOL-1.0))
C COMPUTE THE NEW CAPACITY TO VOLUME RATIO AT EACH GATE
IF(IG .GT. 0) GO TO 742
741 IG = IG + 1
742 IF (IG.GT. NGATE) GO TO 749
IF (L .NE. LGATE(1,IG)) GO TO 746
IF(VOL(J,1) .EQ. 0.)GO TO 749
DO 744 K=1,3
VCR(IG,1,K) = CAP(J,1) / VOL(J,1)
IF(VOL(J,K) .NE. 0) VCR(IG,1,K) = CAP(J,K)/VOL(J,K)
744 CONTINUE
746 DO 747 K=1,3
IF(LCON(L,K) .NE. LGATE(2,IG)) GO TO 747
IF(VOL(J,1) .NE. 0.0)VCR(IG,2,K) = CAP(J,1)/VOL(J,1)
GO TO 749
747 CONTINUE
748 IF(IG1 .EQ. 0) GO TO 741
749 IG1 = IG
C DELAY ON EACH APPROACH
75 CONTINUE
PNS = SVOL/SNCAP
IF(VOL(J,1) .LE. 0.0) GO TO 76
C COMPUTE THE PERCENTAGE STOPS
IF(ITYPEC(1) .EQ. -2) PNS = 1.0
IF(ITYPEC(1) .EQ. -1 .AND. MOD(J,2) .NE. J1) PNS = 1.0
C COMPUTE DELAY BASED ON INVERSE OF CAPACITY. MAKE THEORETICAL MAXIMUM
C OF CAPACITY 2*GCAP(I,J)
DELA (L,1) = NLANE(L)/(AMIN1(2.0, SNCAP/SVOL) *GCAP(I,J))*3600.*
1 (PNS + GO)
NSTOPS(L) = PNS*VOL(J,1)+TP/3600.
C IF CAPACITY EXCEEDED ASSIGN EQUAL VEHICLE PROCESSING TIME TO EACH API
APIHU01200

```



```

      IF(SNCAP .LT. SVOL) DELA(L,1) = SLANE/SNCAP*3600.*
      1 (1.0 + (Q0 + QUE(I,J) + 5.0)/2.0)
      76 DELA(L,2)=DELA(L,1)
      DELA(L,3)=DELA(L,1)
      DELAI(I,J) = DELA(L,1)
      C  QUEUE LENGH AT THE END OF TP
      767 QUEUE(L) = Q0
      QUE(I,J) = Q0
      77 CONTINUE
      IF(ISAVE .NE. 1) PRINT 97
      97 FORMAT(1H-1X,5H N-APPR DELAY QUEUE
      1PR DELAY QUEUE N-APPR DELAY QUEUE )
      ISAVE = I+1
      PRINT 98, I, (DELA(I,J), QUE(I,J), J=1,4)
      90 CONTINUE
      98 FORMAT (13H INTERSECTION I=, 4(F10.0,F7.0,5X))
      RETURN
      END
      INU01210
      INU01220
      INU01230
      INU01240
      INU01250
      INU01260
      INU01270
      INU01280
      INU01290
      INU01300
      S-APINU01310
      INU01320
      INU01330
      INU01340
      INU01350
      INU01360
      INU01370
      INU01380

```

```

SUBROUTINE ZAREA
C  EACH ZONE IS DEFINED BY ADJACENT LINKS FROM WHICH VEHICLES ACCESS
C  THAT ZONE.  IN ADDITION PARKING ZONE LINKS MUST ENCLOSE AN AREA
C  AND THAT AREA IS ASSIGNED A CERTAIN NUMBER OF VEHICLE PARKING SPACES. ZAR00010
C  OF COURSE ALL LINKS SURROUNDING THE AREA MUST BE CONNECTED. OTHERWISE ZAR00020
C  THE AREA WILL NECESSARILY BE INFINITE.  ONE EXCEPTION---THE LAST LINK ZAR00030
C  NEED NOT CONNECT TO THE FIRST LINK WHEN LESS THAN 6 LINKS DEFINE THE ZAR00040
C  ZONE.  ZAR00050
C  COMMON /LINK/ NLINK, NLANE(200), X1(270), Y1(200), X2(200), Y2(200) ZAR00060
C  1. LCAP(200), DIST(200), VEL(200), LCON (200,3) ZAR00070
C  COMMON /ZONES/ NZONES, NZLINK(50), ZLINK(12,50), ZATTR(50), ZAR00080
C  12 GENR (50), NEXT, ZAT(2), ZVT(2), ZVT(3,50), ZNAME(50) ZAR00090
C  COMMON/EXCLUD/NOPARK
C  INTEGER ZNAME
C  INTEGER ZLINK
C  DIMENSION PX(7), PY(7), TRIARE(7)
C  COMMON /PARKZ/ PZ, PV(50), FLA(50), VZ(50), 7V(50), PD, PLS, PLPOZAR00100
C  1, FNOS(50), PLL(50)
C  INTEGER PNOS
C  INTEGER Z
C  DO 52 Z=1,NZONES
C  SAVPLA = PLA(Z)
C  CONTINUE
C  IF(Z .LE. NEXT) GO TO 52
C  NLT = PNOS(Z)
C  XYMAX = 0.0
C  DO 20 NL = 1, NLT
C  L = IABS (ZLINK(NL,Z))
C  XYMAX=PMAX1((X1(L)-X2(L))*2+(Y1(L)-Y2(L))*2
C  &.XYMAX)
C  SPECIAL HANDLING IS REQUIRED FOR THE FIRST AND SECOND LINKS
C  IF ( NL - 2) 13, 17, 23
C  13 PX(1) = X1(L)
C  PX(2) = X2(L)
C  PY(1) = Y1(L)
C  PY(2) = Y2(L)
C  LT = L
C  GO TO 29
C  17 IF (PX(2) .NE. X2(L) ) GO TO 18
C  IF (PY(2) .EQ. Y2(L) ) GO TO 24

```

*X A.

ISMAP MODEL

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```

C THE END POINTS FAIL TO MATCH. TWO POSSIBLE MATCHES REMAIN
18 IF (PX(2) .NE. X1(L)) GO TO 19
   IF (PY(2) .EQ. Y1(L)) GO TO 26
C THE END POINTS FAIL TO MATCH. ONE POSSIBLE MATCH REMAINS
19 PX(2) = PX(1)
   PY(2) = PY(1)
   PX(1) = X2(LT)
   PY(1) = Y2(LT)
C DETERMIN WHICH END OF LINK L CONNECTS TO THE PREVIOUS LINK
20 IF (PX(NL) .NE. X1(L)) GO TO 22
   IF (PY(NL) .EQ. Y1(L)) GO TO 26
22 IF (PX(NL) .NE. X2(L)) GO TO 23
   IF (PY(NL) .EQ. Y2(L)) GO TO 24
C THE NUMBER OF CONNECTED POINTS IS SAVED IN NPT
27 NPT = NL
C THE FIGURE IS NOT CONNECTED AT THE LINK END POINTS
   PRINT 923, ZNAME(Z), ZLINK(NL-1,Z), L
923 FORMAT (7H ZONE *12,32H IS DISCONNECTED BETWEEN LINKS 14,
1 4H AND, 14)
   GO TO 30
24 PX(NL+1) = X1(L)
   PY(NL+1) = Y1(L)
   GO TO 27
26 PX(NL+1) = X2(L)
   PY(NL+1) = Y2(L)
27 IF (NL .EQ. 3 .OP. NL .EQ. 5) GO TO 29
   TRIARE(NL) = (PX(NL-1)*PY(NL) - PX(NL-1)*PY(NL+1) + PX(NL)*PY(NL+1)*PY(NL-1))/ 2.0
1 ) - PX(NL)*PY(NL-1) + PX(NL+1)*PY(NL-1) - PX(NL+1)*PY(NL))/ 2.0
   TRIARE(NL) = ABS(TRIARE(NL))
29 NPT = NL + 1
   IF (NPT .LE. 6) GO TO 30
   NPT = 6
   GO TO 31
C
C EACH AREA COMPUTED IS A POSSIBLE SUBTRACTION FROM THE TOTAL AREA.
C WHEN IT COVERS THE TRIANGLE CREATED BY CONSTRUCTED SIDES. SUB-
CTRACT THE AREA.
C IF A CLOSING LINK WAS LEFT OUT ASSUME IT EXISTS
30 IF (PX(NPT) .NE. PX(1)) GO TO 32
   IF (PY(NPT) .NE. PY(1)) GO TO 32

```

```

      NPT = NPT - 1
      PLL(Z) = -SQRT(XYMAX)
      GO TO 40
C     ONE LINK ZONES ARE LEGAL. ASSUME 12+12+14+14 FOOT WIDTH
      IF(NPT .GT. 2) GO TO 35
      PLL(Z) = SQRT(XYMAX)
      PLA(Z) = PLL(Z) * .52.0
      GO TO 50
      35 PLL(Z) = AMAX1((PX(NPT) - PX(1)) + 2 * (PY(NPT) - PY(1)) + 2 * XYMAX)
      PLL(Z) = -SQRT(PLL(Z))
      IF (NPT .EQ. 3 .OR. NPT .EQ. 5) GO TO 40
      TRIARE(NPT) = (PX(NPT-1) * FY(NPT) - PX(NPT-1) * PY(1) + PX(NPT) * PY(1) - PX(NPT) * PY(NPT)) / 2.0
      1 - PX(NPT) * PY(NPT-1) + PX(1) * PY(NPT-1) - PX(1) * PY(NPT) / 2.0
C     INITIALIZE THE AREA OF THE ZONE
      TRIARE(NPT) = ABS(TRIARE(NPT))
      IF(NPT .LE. 4) GO TO 413
      PLA(Z) = (PX(5) * PY(1) - PX(5) * PY(3) + PX(1) * FY(3) - PX(1) * PY(5)
      1 + PX(3) * PY(5) - PX(3) * PY(1)) / 2.0
      PLA(Z) = ABS(PLA(Z))
      GO TO 415
      413 PLA(Z) = TRIARE(Z)
      415 IF (NPT .LE. 3) GO TO 50
      DO 495 NL = 4, NPT
C     COMPUTE AREA OF TRIANGLE WITH 1,2, OR 3 COMMON SIDES
C     WHERE NL-3 IS THE NUMBER OF SIDES HELD IN COMMON
      IF( NL - 5 ) 417, 43, 45
      417 IC = 1
C     IA IS THE VERTEX OF THE TRIANGLE 1-2-3 AND COMMON SIDE IS 1-3
      IA = 2
      IF ( NPT.NE.4 ) GO TO 42
      419 IF = 4
      GO TO 425
C     IB IS THE VERTEX OF THE TRIANGLE 1-5-3 AND COMMON SIDE IS 1-3
      427 IC = 5
C     COMPUTE THE SLOPE OF THE LINE(OR SIDE) HELD COMMONLY BY TWO TRIANGLES
      425 IF (PX(1) .EQ. PY(3)) GO TO 46
      CF = (PY(1) - PY(3)) / (PX(1) - PX(3))
C     COMPUTE THE INTERCEPT OF THIS LINE WITH THE Y AXIS
      YI = PY(1) - CF * PX(1)
      GO TO 47

```

```

C IA IS THE VERTEX OF THE TRIANGLE 3-4-5, IB IS VERTEX OF 5-1-3
47 IA = 4
   IL = 1
   IC = 3
C COMPUTE THE SLOPE OF THE COMMON SIDE 3-5
   IF(PX(3) .EQ. PX(5)) GO TO 46
   CM = (PY(3) - PY(5))/(PX(3) - PX(5))
   YK = PY(3) - CM * PX(3)
   GO TO 47
C IA IS THE VERTEX OF THE TRIANGLE 5-6-1, IB IS VERTEX OF 1-3-5
48 IA = 6
   IL = 3
   IC = 1
C COMPUTE SLOPE OF COMMON SIDE 5-1
   IF(PX(5) .EQ. PX(1)) GO TO 45
   CM = (PY(5) - PY(1))/(PX(5) - PX(1))
   YK = PY(5) - CM * PX(5)
   GO TO 47
46 IF (PX(IA) .LT. PX(IC)) GO TO 463
   IF (PX(IB) .GT. PX(IC)) GO TO 48
   GO TO 493
463 IF (PX(IP) .GT. PX(IC)) GO TO 493
   GO TO 48
C USING YK AD THE NEW Y ORIGIN COMPUTE THE SLOPE TO EACH NON-COMMON
C TRIANGLE VERTEX
47 AP = (PY(IA) - YK) / PX(IA)
   BP = (PY(IB) - YK) / PX(IB)
C DETERMINE IF BOTH TRIANGLES FALL ON THE SAME SIDE OF THEIR COMMON
C SIDE, AND SUBTRACT THE SMALLER IF THEY DO.
   IF (AP .GT. CM) GO TO 46
   IF (BP .GT. CM) GO TO 493
C TRIANGLES OVERLAP
48 PLA(Z) = PLA(Z) - TRIARE(IA)
   GO TO 495
49 IF (CM .GT. CM) GO TO 49
C TRIANGLES DO NOT OVERLAP
493 PLA(Z) = PLA(Z) + TRIARE(IA)
495 CONTINUE
50 PLA(Z) = AES (PLA(Z))
   IF(PLL(Z) .LT. 0.0) PLL(7) = -PLA(7)/PLL(2) - PLL(Z)

```

ZAR01210
 ZAR01220
 ZAR01230
 ZAR01240
 ZAR01250
 ZAR01260
 ZAR01270
 ZAR01280
 ZAR01290
 ZAR01300
 ZAR01310
 ZAR01320
 ZAR01330
 ZAR01340
 ZAR01350
 ZAR01360
 ZAR01370
 ZAR01380
 ZAR01390
 ZAR01400
 ZAR01410
 ZAR01420
 ZAR01430
 ZAR01440
 ZAR01450
 ZAR01460
 ZAR01470
 ZAR01480
 ZAR01490
 ZAR01500
 ZAR01510
 ZAR01520
 ZAR01530
 ZAR01540
 ZAR01550
 ZAR01560
 ZAR01570
 ZAR01580
 ZAR01590
 ZAR01600

APPENDIX A.

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COMPUTER PROGRAM SOURCE CODE,

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52  IF(SAVPLA .NE. 0.0) PLA(7) = SAVPLA
    PLL(7) = AMAX1(PLL(Z),1.0)
    IF(NOPARK.EQ.1) PRINT 960
960  FORMAT(/,1X,'PARKING ZONE CAPACITIES AND LENGTHS NOT USED IN THE
    &CALCULATION',/)
C    PRINT 953
953  FORMAT (42H-PARKING ZONE CAPACITIES AND TRIP LENGTHS /24H ZONE
    1PACITY LENGTH )
    IZ = NEXT + 1
957  FORMAT(2X,I2,2E15.4)
    DO 57 Z = IZ,NZONES
    PCAP = PLA(7)/PD
    PRINT 557, ZNAME(Z),PCAP,PLL(Z)
C    57  CONTINUE
        RETURN
        END
ZAR01610
ZAR01620
ZAR01630
ZAR01640
ZAR01650
ZAR01660
ZAR01670
ZAR01680
ZAR01690
ZAR01700
ZAR01710
ZAR01720
ZAR01730
ZAR01740
ZAR01750
ZAR01760

```


COMPUTER PROGRAM SOURCE CODE,

ISAF MODEL

A.

```

SUBROUTINE ROUTEV
COMMON / COMM/ I,Z,L,J, K, T00, D0W, TP, TOTATT, ITPZ,TOTGFM,ITM
COMMON / LINK/ NLINK, FLALF(200), X1(200), Y1(200), X2(200), Y2(200)
COMMON / CAP/ LCAP(200), DIST(200), VEL(200), LCON (200,3)
1, LCAP(200), DIST(200), VEL(200), LCON (200,3)
2, NSTOPS(200)
COMMON / INTRST/ NINS, LIN(70,4), ITPC (70), CYCL(70), PH(70,4),
COMMON / GCAP(70,4), GUE(70,4)
1 CI(70), GCAP(70,4), GUE(70,4)
COMMON / ZONES/ NZONES, N7LINK(50), ZLINKS(12,50), ZATTR(50),
1 ZGENR(50), NEXT, ZAT(2), ZGT(2), ZVT(3,50), ZNAME(50)
INTEGER ZNAME
INTEGER ZLINKS
COMMON / GATE/ NGATE, LGATE(2,10), VCR(10, 2,4)
COMMON / VOLUME/ COUNT(4,200)
COMMON / PARKZ/ PZ, PV(50), FLA(50), VZ(50), ZV(50), PD,PLS,PLBR
COMMON / PZ, PV(50), FLA(50), VZ(50), ZV(50), PD,PLS,PLBR
1, PNOS(50), PLL(50)
COMMON / VEHTYP/ VT, VTP(3), VIE(3), VMULT(2), SZVIP(3,2)
COMMON TT(200,3), NC, NR, RO, R(200), CO, C(200)
DIMENSION DELA(200,3)
EQUIVALENCE (NC,DELA(1))
INTEGER R
COMMON RG(200,10), CG(200,10)
1, LISTL(4), CLIST(4), LIST(4)
2, VTHS(4), LCRZF(10,50)
INTEGER RG, Z
DIMENSION QTEMP(4)
DO 12 II7=1,200
12 C(II7)=0.0
IF(ITM.LE. 0) ITM = 1
STP = TP
DO 50 IT = 1,ITM
TP = (STP*IT)/ITP
DO 25 IG = 1, NGATE
C GET C AND R ARRAYS FROM EACH GATE LINK PAIR
18 CALL MINPTH (LGATE(1,IG), 2)
DO 19 L = 1,NLINK
RG (L, IG) = R(L)
19 CG (L, IG) = C(L)
C GET ARRAY OF LINK NUMBERS WHICH IDENTIFY THE COST AND ROUTE FROM EACH
C IG TO EACH ZONE

```

```

NO 24      Z = 1, NZONES
IOPE = 1
IF( Z .LE. NEXT) IOPE = 2
C1 = 1.0E10
L1 = 0
L2 = 0
NZL = NZLINK (7)
DO 21      J = 1, NZL
L = ZLINKS(J,2)
IF( L .LE. 0) GO TO 21
C WHERE A GATE LINK AND ZONE LINK ARE EQUAL (I.E. EXTERNAL ZONE TO
C OUTGOING GATE LINK, AND INTERNAL ZONE TO INCOMING GATE LINK)
C PATHS ARE VOID.
IF (LGATE(IOPE,IG) .EQ. L) GO TO 21
C GET 2 MIN COSTS TO EACH ZONE
IF (C(L) .GE. 1.0E10) GO TO 21
IF (L2 .LE. 0) GO TO 20
IF (C(L2) .LT. C(L)) GO TO 21
L2 = L
20      IF ( C1 .LT. C(L) ) GO TO 21
L2 = L1
C1 = C(L)
L1 = L
21      CONTINUE
C IDENTIFY LINK WHICH SHOWS LEAST COST
LCPZ (IG, Z, 2) = L2
22      LCRZ (IG, Z, 1) = L1
C FIND THE FIRST LINK IN THE ROUTE FROM THE GATE TO ZONE
23      IF( L1 .LE. 0) GO TO 24
L2 = L1
L1 = P(L2)
GO TO 234
24      LCRZF(IG,Z) = L2
25      CONTINUE
C
C
C FOR EACH ZONE GET A COST AND ROUTE ARRAY TO ALL LINKS IN THE NETWORK. ROU00770
C DETERMINE A COST AND ROUTE THRU EACH GATE TO EACH INT/EXTERNAL ZONE. ROU00780
C DETERMINE THE NUMBER OF VEH GOING THRU EACH GATE. APPLY VEH TO THE ROU00790
C APPROPRIATE ROUTE ROU00800

```

ROU00410
 ROU00420
 ROU00430
 ROU00440
 ROU00450
 ROU00460
 ROU00470
 ROU00480
 ROU00490
 ROU00500
 ROU00510
 ROU00520
 ROU00530
 ROU00540
 ROU00550
 ROU00560
 ROU00570
 ROU00580
 ROU00590
 ROU00600
 ROU00610
 ROU00620
 ROU00630
 ROU00640
 ROU00650
 ROU00660
 ROU00670
 ROU00680
 ROU00690
 ROU00700
 ROU00710
 ROU00720
 ROU00730
 ROU00740
 ROU00750
 ROU00760

```

C - - - - -
DO 50 Z=1, NZONES
  NZ = NZLINK(Z)
  CALL MINPTH ( ZLINKS (1, Z), IZ )
  C DETERMINE WHETHER TO ROUTE VEHICLES FROM EXTERNAL ZONE THRU ENTRANCE
  C GATE OR FROM INTERNAL ZONE THRU EXIT GATE.
  IF ( Z.LE. NEXT ) GO TO 31
  IORE = 1
  IZ1 = 1
  IZ2 = NEXT
  GO TO 33
31 IOPE = 2
  IZ1 = NEXT+1
  IZ2 = NZONES
  C ROUTE VEHICLES FROM ORIGIN ZONE Z TO EACH POSSIBLE DESTINATION ZONE
32 DO 50 IZ = IZ1, IZ2
  GCFT = 0.0
  ZVZEH = VZ(IZ)* ZGENP(Z)/ZGT(3-IORE)
  DO 33 K=1,4
  LISTG(K) = 0
  LISTL(K) = 0
33 CLIST(K) = 1.0E10
  NK = 0
  C MAKE UP A LIST IDENTIFYING 4 ROUTES WITH MINIMUM TRAVEL TIMES
  C FOR EACH GATE DETERMINE THE GATE CAPACITY,VOLUME,TRAVEL TIME RATIO
  DO 38 IG = 1,NGATE
  LG = LGATE (IORE,IG)
  IF(LG.LE. 0) GO TO 38
  C INITIALIZE LG THE LINK NUMBER WHEN USING GATE IG.
  C TEST THAT THE LINK AT THE GATE IS ALSO THE FIRST IN THE ROUTE TO IZ
  IF(LG.NE. LCR2F(IG,IZ)) GO TO 38
  DO 37 IK = 1,2
  C GENERATE THE FACTORS FOR ALLOCATION OF VEHICLES TO ALTERNATE ROUTES
  LZ = LCR2(IG,IZ,IK)
  IF(LZ.LE. 0) GO TO 37
  DO 36 K=1,4
  IF(C(LG) + CG(LZ,IG).GE. CLIST(K)) GO TO 36
  IF(K.EQ. 4) GO TO 335
  C ADD GATE, LINK AND COST TO LIST
  JK = 3

```

ROU00810
 ROU00820
 ROU00830
 ROU00840
 ROU00850
 ROU00860
 ROU00870
 ROU00880
 ROU00890
 ROU00900
 ROU00910
 ROU00920
 ROU00930
 ROU00940
 IROU00950
 RGU00960
 ROU00970
 ROU00980
 ROU00990
 ROU01000
 ROU01010
 ROU01020
 ROU01030
 ROU01040
 GCR001050
 ROU01060
 ROU01070
 ROU01080
 ROU01090
 ROU01100
 ROU01110
 ROU01120
 ROU01130
 ROU01140
 ROU01150
 ROU01160
 ROU01170
 ROU01180
 ROU01190
 ROU01200

```

DO 334 KK = K,3
LISTG(JK+1) = LISTG(JK)
LISTL(JK+1)=LISTL(JK)
CLIST(JK+1) =CLIST(JK)
GCR(JK+1) = GCR(JK)
334 JK = JK-1
335 LISTG(K) = IG
LISTL(K) = LZ
CLIST(K) = C(LG) + CG(LZ,IG)
NK = MIN0(NK+1,4)
I1 = 1
C LOCATE THE CORRECT CAPACITY FOR THIS TURNING MOVEMENT
IF(CIORE .EQ. 1) GO TO 347
LG1 = F( LG)
IF(LG1 .LE. 0) GO TO 35
DO 34 J=1,3
IF(LCON(LG1,J) .EQ. LG) I1 = J
34 CONTINUE
GO TO 35
343 DO 345 J= 2,3
LG1 = LCON(LG,J)
IF(LG .EG. R(LG1)) I1 = J
345 CONTINUE
35 GCR(K) = VCA(IG,IOCE,I1)/(C(LG)+CG(LZ,IG))
GO TO 77
36 CONTINUE
37 CONTINUE
38 CONTINUE
DO 385 K=1,NK
GCR1 = GCR1 + GCR(K)
DO 39 K = 1,4
VEHS(K) = GCR(K)/GCR1 + 72VEH
VEHS(K) = VEHS(K) / I1
39 CONTINUE
C PRINT G39, ZNAME(Z),ZNAME(I2),(LISTG(K),LISTL(K),CLIST(K),VEHS(K)
C 1, K=1,NK)
C939 FORMAT (6H ZONE 12,9H TO ZONE 12,19H GATE LINK,COST,VEH ,
C 1 4(2I3, F5.0, F10.7))
C
C
C

```

```

C APPLY VEHICLES TO THE LINKS OF THE NETWORK OF 4 POSSIBLE ROUTES
DO 40 K=1,4
C RECOVER LAST LINK IN THE ROUTE
LZ = LISTL(K)
IF(LZ .LE. 0) GO TO 49
IG = LISTG(K)
C STORE THE NUMBER THAT TERMINATE ON THIS LINK BEFORE TURNING ST,PT,LT
COUNT(4,LZ) = COUNT(4,LZ) + VEH$(K)
C BACK UP ONE LINK
41 LG = RG(LZ,IG)
IF (LG.LE. 0) GO TO 45
C FIND OUT IF CONNECTION IS ST,PT,LT
DO 42 J = 1,3
IF (LCON (LG,J) .NE. LZ) GO TO 42
COUNT(J,LG) = COUNT(J,LG) + VEH$(K)
GO TO 43
42 CONTINUE
CALL EXIT
43 LZ = LG
GO TO 41
C LZ'S THE LAST LINK IN ROUTE TO THE GATE
C BACK UP ONE LINK
44 LC = RC(LZ)
IF(LG.LE. 0) GO TO 40
C FIND OUT IF CONNECTION IS ST,PT,LT
DO 46 J=1,3
IF (LCON (LG,J) .NE. LZ) GO TO 44
COUNT(J,LG) = COUNT(J,LG) + VEH$(K)
GO TO 47
46 CONTINUE
47 LZ = LG
GO TO 45
48 CONTINUE
50 CONTINUE
IF(IT.EQ. ITM) GO TO 60
DO 70 I=1,NINS
DO 60 J=1,4
QTEMP(J) = QUE(I,J)
IF (ITYPC(I) .GT. 0) GO TO 61
CALL INSEC

```

ROU01610
 ROU01620
 ROU01630
 ROU01640
 ROU01650
 ROU01660
 ROU01670
 ROU01680
 ROU01690
 ROU01700
 ROU01710
 ROU01720
 ROU01730
 ROU01740
 ROU01750
 ROU01760
 ROU01770
 ROU01780
 ROU01790
 ROU01800
 ROU01810
 ROU01820
 ROU01830
 ROU01840
 ROU01850
 ROU01860
 ROU01870
 ROU01880
 ROU01890
 ROU01900
 ROU01910
 ROU01920
 ROU01930
 ROU01940
 ROU01950
 ROU01960
 ROU01970
 ROU01980
 ROU01990
 ROU02000

```

61      GO TO 62
62      CALL INSEC
        DO 65 J=1,4
        QUE(I,J) = QTEMP(J)
        L = LJM(I,J)
        IF(L.LE.0) GO TO 65
        IF(VEL(L).LE.0.) GO TO 65
        DO 64 K=1,3
        TT(L,K) = DIST(L)/VEL(L) + DELA(L,K)
64      CONTINUE
65      CONTINUE
70      CONTINUE
80      TF = STP
        RETURN
        END
        ROU02010
        ROU02020
        ROU02030
        ROU02040
        ROU02050
        ROU02060
        ROU02070
        ROU02080
        ROU02090
        ROU02100
        ROU02110
        ROU02120
        ROU02130
        ROU02140
        ROU02150

```



```

SUBROUTINE FINTPH (LINKS, NL)
C THIS ROUTINE COMPUTES THE MINIMUM TIME PATH FROM NL ORIGIN LINKS
C L TO ALL ACCESSIBLE LINKS IN A TRAFFIC NETWORK. ARRAY C STORES THE
C COST OR TRAVEL TIME TO EACH LINK AND ARRAY R STORES THE ROUTES FROM
C EACH LINK TO L ON COMPLETION.
COMMON / COMM/ I,Z,L,J, K, YOD, DOW, TP, TOTATT, TTPZ,TOTGEN,ITM
1,NYEAR,LHEAD(12)
COMMON / LINK / NLINK, NLANE(200), X1(200), Y1(200), X2(200), Y2(200)
1), CAP(200),DIST(200), VEL(200), LCON (200,3),NSTOPS(200)
INTEGER R
COMMON TT(200,3),NC,NR,RO, R(200), CO, C(200)
DIMENSION LINKS(12)
NC = NLINK
DO 15 L = 1, NC
C (L) = 1.0E10
DO 17 L = 1, NC
R (L) = 0
L=1
DO 19 I =1,NL
IF (LINKS(I) .LE.0) GO TO 19
L = LINKS(I)
C (L) = -1.0
CONTINUE
GO TO 3
IF ( L.GE. NLINK) L = 0
L = L +1
IF (L .EQ. LS ) GO TO 4
IF (C(L) .GE. 0) GO TO 20
LF = 0
DO 4 J =1,7
LC = LCON(L,J)
IF ( LC .EQ. 0) GO TO 4
IF (TT(L,J) - C(L) .GE. ABS(C(L))) GO TO 4
C (LC) = C(L) - TT(L,J)
R (LC) = L
LF = J
CONTINUE
C (L) = -C(L)
LS = L
IF ( LF .EQ. 0) GO TO 20

```

MIN00410
MIN00420
MIN00430
MIN00440
MIN00450
MIN00460
MIN00470

```

9      L = LCON(L, LF)
C      GO TO 3
C      CONTINUE
C      PRINT 98, (R(L), C(L), L=1, NC)
C98    RETURN
C      FORMAT (* MFATH*/5(I5, F10.0))
C      END

```

```

SUBROUTINE PARKING
C THIS SUB-MODEL PREDICTS AVERAGE TRAVEL TIME TO VEHICLES ENTERING A
C PARKING AREA OR ZONE. AT AN AVERAGE SPEED OF 7.0 MPS VEHICLES MOVE
C THROUGH THE PARKING ZONE. TRAVEL TIME (TT) IN THE ZONE IS PROPORTIONAL
C TO THE PARKED VEHICLE TO ZONE CAPACITY RATIO. QUEUING OCCURS WHEN
C HEADWAYS ARE LESS THAN THE TIME REQUIRED TO BACK OUT OF AND TO CLEAR
C A PARKING STALL, OR WHEN VEHICLES MOVING IN THE ZONE PLUS PARKED
C VEHICLES EXCEEDS CAPACITY.
COMMON / COMM / I,Z,L,J, K, TOD, DOW, TP, TOTATT, TTPZ,TOTGEN
COMMON / PARKZ / PZ, PV(50), PLA(50), V7(50), ZV(50),FD,PLS,PLBP,AR00100
10,PNOS(50),PLL(50)
COMMON / ZONES / NZONES, NZLINKS(50), ZLINKS(12,50), ZATTR(50),
1ZGENR(50), NEXT, ZAT(2), ZVT(2), ZVI(3,50), ZNAME(50)
COMMON / EXCLUD / NO PARK
C VZ ARE ZONE ATTRIBUTES AND ZV ARE ZONE GENERATIONS
INTEGER Z, PZ
REAL NVL
C COMPUTE THE CAPACITY OF THE PARKING ZONE
Z = PZ
PC = PLA(PZ) / PD
C COMPUTE MAXIMUM PARKING LOT DISCHARGE RATE
FLDR = AMAX1(0.5,PC/2400.)
C COMPUTE THE TOTAL DRIVEABLE LENGTH OF THE PARKING ZONE
C STALLS ASSUMED 7 METERS IN WIDTH AND AT 45 DEGREE ANGLE
FLL = PC * 3.0 / 1.414
PL = FLL(PZ)
C COMPUTE THE PARKED VEHICLES AT END OF TIME PERIOD
PV7 = AMAX1( VZ( Z) - 7V( Z) + FV(PZ) , 0.0)
C COMPUTE PARKING UTILIZATION
PU = PVZ / PC
C COMPUTE SPEED BASED ON GCA VALIDATION STUDY OF CO MODEL AUG 74 P27
PLSS = PLS
PLS = 21.0-11.2*PU
PLS = AMAX1(10.75,PLS)
C ASSIGN A PARKING LOT SPEED BASED ON TACOMA STUDY
PLS = 0.3
C THE TRAVEL TIME FOR ARRIVING VEHICLES
IF(PU.LT. .59) GO TO 21
TTA = PU * PL/PLS
GO TO 25

```

```

C21  TTA = (PVZ + PV(PZ))/2.0 / PC * PL / PLS
C  DEPARTURES EXPERIENCE DIFFERENT TRAVEL TIME
C25  TTA = AMAX1 (TTA, PL/2.0/PLS)
C  TTA = AMAX1(TTA, PLA(PZ) / PL / PLS)
C  TTA = AMAX1(TTA, PLA(PZ) / PL / PLS)
C  TTA = PL/PLS
C  TTD = TTA + PLB0
C
C  QUEUEING
C
C  NVL I S THE NUMBER OF VEHICLES DRIVING THRU THE LOT AT ANY TIME
C  DQ = 0.0
C  NVL = (TTA * VZ(Z) + TTD * ZV(Z))/TP + .000275
C  IF(NVL + PVZ - PC .GE. 0.0) GO TO 33
C  IF(PC .GE. 0.55) GO TO 33
C  CHECK HEADWAYS AGAINST TIME TO PACK OUT OF STALL
C  THERE IS NO QUEUING.
C  AWG = 0.0
C  GO TO 39
C  COMPUTE THE DELAY CAUSED BY WAITING FOR VEHICLES TO BACK OUT OF STALLS
C  IF(VZ(Z) .GT. 0.0)
C  100 = AMAX1 ( PLB0 + PLB0 / (2.0 * (TP / VZ(Z) - 1.0 / PLDR)), PLB0 / 2.0 ) *
C  1 (PU - .65) / 0.15
C  COMPUTE THE DELAY CAUSED BY EXCEEDENCE OF PARKING ZONE CAPACITY
C  AWG = 0.0
C  IF ( PVZ + PV(PZ) + NVL .LT. PC * 2.0 ) GO TO 35
C  AWG = ((PVZ + PV(PZ)) / 2.0 + NVL - PC) * TP / (ZV(Z) + 1.0)
C  GO TO 39
C  IF ( PVZ .GE. PC ) GO TO 37
C  IF ( PV(PZ) .LT. PC ) GO TO 39
C  EXISTING QUEUE IS DISSIPATING
C  AWG = (PV(PZ) - PC + NVL) * 2 / (ZV(Z) - VZ(Z)) * .5 * TP / ZV(Z)
C  GO TO 39
C  ARRIVALS ARE BUILDING A QUEUE
C  37  AWG = (PVZ - PC + NVL) * 2 / (VZ(Z) - ZV(Z)) * .5 * TP / (ZV(Z) + 1.0)
C  30  CONTINUE
C  ADD A VEHICLE IDLEING TIME IF NO QUEUE EXISTS
C  THIS INCLUDES COSTS TO ENTER THE ZONE BASED ON TACOMA STUDY
C  AWG = AMAX1(AWG, 0.67 * TTA)
C  PLS = PLS

```

```

C TOTAL THE RUNNING TIME IN PARKING ZONE
  TTFZ=(TTA + DG + AWQ) * VZ(2) + (TTD + AWQ) * ZV(Z)
  IF(P2.EQ.NEXT+1) PRINT 97
  97  FORMAT (1H-15X, 4HZONE,3X,10HTOTAL TIME 3X 7HTT /RPV,3X 7HTT DEPT,PAR00830
  12XHHACKING G,3X 7HG DELAY,3X 7HDEPARTS,3X 7HARRVALS,4X6HLENGTH) PAR00840
  IF(NOPARK.EQ.1) PRINT 971
  971 FORMAT(//,1X,THE FOLLOWING INFORMATION CONCERNING PARKING ZONES PAR00860
  8DOES NOT APPLY SINCE PARKING LOT EMISSIONS ARE NOT CONSIDERED-,/) PAR00870
  PRINT 98, ZNAME(7), TIPZ, TTA, TTD, DG, AWQ, ZV(Z),VZ(7), PL PAR00880
  94  FORMAT(1H , - PARKING -,7Y,13,16X,EE10,7) PAR00890
  RETURN PAR00900
  END PAR00910
      PAR00920

```

```

SUBROUTINE COORXY
  PURPOSE IS TO ORGANIZE THE X,Y COORDINATES OF EACH LINK SO THAT
  X1, Y1 ARE UPSTREAM AND X2, Y2 ARE THE DOWNSTREAM COORDINATES.
  ALSO CONVERT COORDINATES FROM FEET TO METERS IN THIS WRITING
  OF THE SUBROUTINE.
  COMMON /LINK/ NLINK, NLINK(200), X1(200), X2(200), Y2(200)
  1 * LCAP(200), DIST(200), VEL(200), LCON(200,3)
  DATA FOTMET / 0.3048 /

  DO 900 L = 1, NLINK
    GO 100 J = 1, 7
    IF (LCON(L,J) .EQ. 0) GO TO 100
    LC = LCON(L,J)
    GO TO 200
  CONTINUE
  GO TO 500

100  CONTINUE
  GO TO 900

  COMPUTE DISTANCES
  CONTINUE
  DIST1 = (X1(L) - X1(LC))**2 + (Y1(L) - Y1(LC))**2
  DIST2 = (X1(L) - X2(LC))**2 + (Y1(L) - Y2(LC))**2
  DIST3 = (X2(L) - X1(LC))**2 + (Y2(L) - Y1(LC))**2
  DIST4 = (X2(L) - X2(LC))**2 + (Y2(L) - Y2(LC))**2

  LC1 = 0
  IF (DIST1 - DIST2) 400, 250, 250
  CONTINUE
  IF (DIST2 - DIST3) 200, 300, 300
  CONTINUE
  IF (DIST2 - DIST4) 200, 300, 300
  CONTINUE
  LC1 = 1
  GO TO 700
  CONTINUE
  IF (DIST3 - DIST4) 450, 850, 750
  CONTINUE
  IF (DIST1 - DIST3) 450, 450, 500
  CONTINUE
  IF (DIST1 - DIST4) 700, 700, 500
  CONTINUE

```



```

700      IF(DIST3 - DIST4)250,850,750
      CONTINUE
      XTEMP = X1(L)
      X1(L) = X2(L)
      X2(L) = XTEMP
      YTEMP = Y1(L)
      Y1(L) = Y2(L)
      Y2(L) = YTEMP
      IF(LC1)750,850,750
750      CONTINUE
      XTEMP = X1(LC)
      X1(LC) = X2(LC)
      X2(LC) = XTEMP
      YTEMP = Y1(LC)
      Y1(LC) = Y2(LC)
      Y2(LC) = YTEMP
850      CONTINUE
900      CONTINUE
      DO 910 L=1,NLINK
      CONVERT X1 X2 Y1 Y2 FROM FEET TO METERS
      X1(L) = X1(L) * FOTMET
      Y2(L) = X2(L) * FOTMET
      Y1(L) = Y1(L) * FOTMET
      Y2(L) = Y2(L) * FOTMET
910      CONTINUE
      RETURN
      END
      C0000410
      C0000420
      C0000430
      C0000440
      C0000450
      C0000460
      C0000470
      C0000480
      C0000490
      C0000500
      C0000510
      C0000520
      C0000530
      C0000540
      C0000550
      C0000560
      C0000570
      C0000580
      C0000590
      C0000600
      C0000610
      C0000620
      C0000630
      C0000640
      C0000650
      C0000660
      C0000670

```

```

SUBROUTINE EMIT
C
C DETERMINE EMISSIONS OF HC,CO, CO2, NOX
C
REAL MISS
DIMENSION DQ(200)
DIMENSION TIME(4), EMISS(200,4)
DIMENSION PRT(50)
COMMON / COM4 / I,Z,L,J,K,IOU,DOW,TP,TOTATT,ITPZ,TOTGEN,ITH
1,NYEAR,LHEAD(13),TURFAC
COMMON / LINK / NLINK, NLANK(200), X1(200), Y1(200), X2(200), Y2(200)
1,LCAP(200),DIST(200), VFL(200), LCON(200,3), NSTOPS(200)
COMMON / ZONES / NZONES, NZLINKS(50), ZLINKS(12,50), ZATTR(50),
1ZGENR(50), NEXT, ZAT(2), ZGT(2), ZVT(2,50), ZNAME(50)
COMMON / VOLUME / COUNT(4,200)
COMMON / PARK / PZ, PV(50), PLA(50), VZ(50), ZV(50), PD,PLS,PLE
10,PNOS(50), PLL(50)
COMMON TT(200,3), DELA(200,3), GZ(50), QUEUE(200)
1,OC(200,4),DLINK(200,4),CCOUNT(200),MISS(200,4),CMISS(200,4)
INTEGER Z
COMMON/ELINK/IREG,FPARAM(10),IFLAG(3)
DIMENSION ECRU(20),ECRUZ(20)
DATA IO,I1/O,1/
DATA R75/R75,0/
DATA R5/R5,0/
DATA R0,R1/O,0,1,0/
DATA I77/I77/
EQUIVALENCE (QUEUE,DG),(PRT,G4)
EQUIVALENCE (O,EMISS)

C
C SET UP MATRIX OF EMISSION CORRECTION FACTORS BY SPEED
C FOR THE SCENARIO SPECIFIED IN ELINK
C
IYEAR=IFIX(NYEAR/10000.)
WRITE (6,955)IREG,IYEAR,(EPARAM(IJ1),IJ1=1,10)
955 FORMAT('1EMISSIONS SUBMODEL '// -----'//
8/'REGION =',I3,
8/'YEAR =',I3,
8/'TEMP.COLD.HOT,CCOLD=',4F10.3,
8/'VMTMIX=',6F10.3/)

```

```

C CALL SUP8 TO CALCULATE DAST YEAR LDV EMISSIONS
C (REPLACED BY DATA STATEMENTS)
C
C CALL SUP8(I1,I1,I77,P5,R75,R0,R0,R0,R1,R0,R0,R0,R0,R0,10,10,10,10,
C RECRU(1),EIDL77)
C DO 7 IS=2,20,1
C S=FLOAT(IS)*3.0+2.0
C CALL SUP8(I0,I1,I77,S,R75,RU,R0,R0,R0,R0,R0,R0,R0,R0,10,10,10,10,
C RECRU(IS),EIDL77)
C DATA EIDL77/25.17/
C DATA ECRU/128.83,116.55,93.22,65.51,54.81,47.49,41.88,
C 837.25,33.29,29.33,27.16,14.98,23.25,22.22,21.58,21.06,
C 820.39,19.11,16.80,15.70/
C
C CALL SUP8 TO CALCULATE EMISSIONS FOR SCENARIO AND
C TO COMPUTE EMISSION CORRECTION FACTORS AT SPEED IS
C
C CALL SUP8(I1,I77,IYEAR,P5,EPARAM(1),EPARAM(2),EPARAM(3),
C EPARAM(4),EPARAM(5),EPARAM(6),EPARAM(7),EPARAM(8),EPARAM(9),
C EPARAM(10),IFLAG(1),IFLAG(2),IFLAG(3),ECRU7(1),EIDL)
C DO 6 IS=2,20,1
C S=FLOAT(IS)*3.0+2.0
C CALL SUP8(I0,I77,IYEAR,S,EPARAM(1),EPARAM(2),EPARAM(3),
C EPARAM(4),EPARAM(5),EPARAM(6),EPARAM(7),EPARAM(8),EPARAM(9),
C EPARAM(10),IFLAG(1),IFLAG(2),IFLAG(3),IFLAG(4),EIDL)
C ECRU7(IS)=ECRU7(1)/ECRU7(3)
C ECRU7(1)=ECRU7(1)/ECRU7(3)
C CALL INITMM
C ITEST=0
C
C CHECK IF SUPPLEMENTAL EMISSION PARAMETERS ARE CALLED FOR
C IF SO, CORRECT IDLE EMISSIONS AND PRINT MESSAGE
C
C DO 7 I=1,3
C 7 ITEST=IFLAG(I)+ITEST
C IF (ITEST.NE.0) FIDL=EIDL77*ECRU7(1)
C IF (ITEST.NE.0) WRITE (6,6)
C 6 FORMAT(' CAUTION: IM,TRUCK,OR ALH CORRECTION CALLED FOR /
C IDLE EMISSIONS CALCULATED BY ALTERNATE METHOD')
C

```

APPENDIX A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE *

ENVIRONMENTAL PROTECTION AGENCY

```

C      CIDL=LIDL/60.

```

```

C      WRITE(6,987) ECRU2

```

```

C      987 FORMAT(1H0,"EMISSION CORRECTION"/4(1X,SF10.6/))
C      ACC RATE =3.41 MI/HR/SEC OF 5 FT/SEC/SEC
C      ACC=7.41
C      ACCR=5.0

```

```

C      PRINT 110

```

```

110

```

```

      FORMAT(10H-EMISSIONS/131H LINK NSTOPS GLENGTH
      1ED E AT SPEED DISTANCE E DECEL DISTANCE
      2CL E ACCFL DISTANCE )
      DO 100 KP=1,NLINK
      CCOUNT(KP)=COUNT(1,KP) + COUNT(2,KP)+ COUNT(3,KP)
      IF(CCOUNT(KP).LE.0.0)CCOUNT(KP)=COUNT(4,KP)
      CAPL = 1200.0*NLANF(KP)
      IF(VEL(KP) .GT.70) CAPL = CAPL * 1.5
      V = VEL(KP)*(1.0-0.5*CCOUNT(KP)/CAPL)
      S=V*3600.0/5280.0
      TT1=DIST(KP)/V
      IF(NSTOPS(KP).LE.00) GO TO 19
      TT2=(TT(KP,1)+CCOUNT(KP)-((COUNT(KP)-NSTOPS(KP))*TT1)/NSTOPS(KP)
      TIME(2)=V/ACCR
      TIME(4)=TIME(2)
      DIST1=TIME(2)*V/2.
      DISDC=DIST(KP)-DO(VP)-2.*DIST1
      IF(DISDC.GE.0.0) GO TO 3
      DIST1=AMAX1(DIST1+DISDC/2.,0.0)
      DISDC=0.0
      DIST2=DIST1
      TIME(1)=DISDC/V
      TIME(3)=TT2-TIME(1)-2.*TIME(2)
      IF (TIME(3).GE.0.0) GO TO 4
      TIME(2)=AMAX1(TIME(2)+TIME(3)/2.,0.0)
      TIME(3)=0.0
      TIME(4)=TIME(2)

```

```

5 CONTINUE

```

```

60 TO 22

```

```

19 CONTINUE

```

```

      IF(DO(KP).LE.0.0) GO TO 74

```

```

EMI00810
EMI00820
EMI00830
EMI00840
EMI00850
EMI00860
EMI00870
EMI00880
EMI00890
SPEEMI00900
DISTANEMI00910
EMI00920
EMI00930
EMI00940
EMI00950
EMI00960
EMI00970
EMI00980
EMI00990
EMI01000
EMI01010
EMI01020
EMI01030
EMI01040
EMI01050
EMI01060
EMI01070
EMI01080
EMI01090
EMI01100
EMI01110
EMI01120
EMI01130
EMI01140
EMI01150
EMI01160
EMI01170
EMI01180
EMI01190
EMI01200

```

```

      TT2= TT1-TT(KP,1)
      IF(TT2.LT.0.0) GO TO 2*
      DIS1=TT2/2.*V/2.
      DISDC=DIS1(KP)-2.*DIS1
      IF(DISDC.GE. 0.0) GO TO 4
      DIS1 = AMAX1 (DIS1+DISDC/2, 0.0)
      DISDC = 0.0
      DIS2 = DIS1
      DQ(KP)=0.0
      TIME(1)=DISDC/V
      TIME(3)=0.0
      TIME(2)=(TT(KP,1)+TT7-TIME(1))/2.
      TIME(4)=TIME(2)
      GO TO 22
2* CONTINUE
      DISDC=DIS1(KP)-DQ(KP)
      DISDC=AMAX1(0.0,DISDC)
      DIS1=DQ(KP)/2.
      DIS2=DIS1
      DQ(KP)=0.0
      TIME(1)=DISDC/V
      TIME(2)=(TT(KP,1)-TIME(1))/2.
      TIME(3)=0.0
      TIME(4)=TIME(2)
      GO TO 22
24 CONTINUE
      DIS1=0.0
      DIS2=DIS1
      DISDC=DIS1(KP)
      TIME(1)=DISDC/V
      TIME(2)=0.0
      TIME(3)=TIME(2)
      TIME(4)=TIME(2)
      GO TO 22
22 CONTINUE
      C
      C COMPUTE EMISSIONS FOR THOSE NOT DELAYED
      C PLUS CONSTANT CRUISE FOR THOSE DELAYED.
      C
      TS=IFIX((S-0.5)/7.0)
      IF(IS.LT.1) IS=1

```

```

EMI01210
EMI01220
EMI01230
EMI01240
EMI01250
EMI01260
EMI01270
EMI01280
EMI01290
EMI01300
EMI01310
EMI01320
EMI01330
EMI01340
EMI01350
EMI01360
EMI01370
EMI01380
EMI01390
EMI01400
EMI01410
EMI01420
EMI01430
EMI01440
EMI01450
EMI01460
EMI01470
EMI01480
EMI01490
EMI01500
EMI01510
EMI01520
EMI01530
EMI01540
EMI01550
EMI01560
EMI01570
EMI01580
EMI01590
EMI01600

```



```
      PRINT 111, KP, NSTOPS(KP), DR(KP), C(COUNT(KP), V, (EMISS(KP, JM),
10LINK(KP, JM), JM = 1.4)
111  FORMAT (2I5, 3I11.4, 4(E12.4, E10.4))
100  CONTINUE
      C  EMISSIONS RATES ARE COMPUTED FOR EACH ZONE IN GRAMS/SEC
      DO 75 IZ = 1, NZONES
          IF (IZ .LE. NEXT) GO TO 73
      C  COMPUTE A RATE OF EMISSIONS FROM THE ZONE
          PR1(I2) = PR1(I2) + EIDL/IP
          GO TO 75
      C  EMISSION RATES ARE READ INTO PLA FOR EXTERIOR ZONES.
73      PR1(I2) = PLA(I2)
75      CONTINUE
          RETURN
      END
```

EMI02010
EMI02020
EMI02030
EMI02040
EMI02050
EMI02060
EMI02070
EMI02080
EMI02090
EMI02100
EMI02110
EMI02120
EMI02130
EMI02140
EMI02150

```

C
SUBROUTINE DISPER
  THIS ROUTINE CONTROLS THE DISPERSION COMPUTATIONS
  COMMON/DISP/X0(200),Y0(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
  1.YEAF(24),YCONSL,YCONS7,7COEFF(24),ZEXP(24),7CONST,GRDS17,PCVG
  2ELMIX,ISTAR(24),SLAT,ICLD(24),NMET,NY,ITIME,HEIGHT(200)
  COMMON/LINK/NLINK,NLANE(700),X1(200),Y1(200),X2(200),Y2(200),LCAP(
DIS00010
DIS00020
DIS00030
DIS00040
DIS00050
DIS00060
DIS00070
DIS00080
DIS00090
DIS00100
DIS00110
DIS00120
DIS00130
DIS00140
DIS00150
DIS00160
DIS00170
DIS00180
DIS00190
DIS00200
DIS00210
DIS00220
DIS00230
DIS00240
DIS00250
DIS00260
DIS00270
DIS00280
DIS00290
DIS00300
DIS00310
DIS00320
DIS00330
DIS00340
DIS00350
DIS00360
DIS00370
DIS00380
DIS00390
DIS00400
  1200),DIST(200),VEL(200),LCON(200,3),NSTOPS(200)
  COMMON / COMM / I,Z,L,J, K, T0U, D0W, TP, TOTATT, TTPZ,TOTGEN,ITM
  1,NYEAR,LHEAD(18), TUMFAC
  COMMON /ZONES/ NZONES, NZLINS(50), ZLINKS(12,50), ZATTR(50),
  126ENR (50), NEXT, ZAT(2), 7GT(2), 7VT(3,50), ZNAME(50)
  COMMON /MAIN/M
  COMMON/CONCTR/CONC(200)
  CALL WIND
  CALL LSLOPE
  IF(NMET.EQ.0) GO TO 4
  CALL STABLE
  DO 3 I=1,NLINK
    N=X1(I)*10.+0.5
    X1(I)=N/10.
    N=X2(I)*10.+0.5
    X2(I)=N/10.
    N=Y1(I)*10.+0.5
    Y1(I)=N/10.
    N=Y2(I)*10.+0.5
    Y2(I)=N/10.
    DO 2 M=1,NUMREC
      CONC(M) = 0.0
    CALL BASIC
    IF(NZONES.EQ.0.) GO TO 14
    CALL GENGSC
    CALL ZPORDR
  C
  C MULTIPLY CONCENTRATION BY PPM CONVERSION
  C FACTOR, DIVIDE BY PI AND WIND SPEED, AND ADD BACKGROUND CONCTR.
  14 NN=NY-70
  DO 24 M=1,NUMREC
    24 CONC(M)=((CONC(M)*.77.)/(3.1415926*WS(ITIME)))
  R+ECKGRD
  RETURN
  END

```

```

C
C
C
SUBROUTINE WIND
THIS ROUTINE CONVEPTS METEOROLOGICAL WIND DIRECTION TO TRIGONO-
METRIC DIRECTION. WITH ZERO DEGREES ON POSITIVE X-AXIS AND
PROCEEDING COUNTERCLOCKWISE.
COMMON/DISP/XO(200),YO(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
1.YEXP(24),YCONSL,YCONS2,ZCOEFF(24),ZEXP(24),ZCONST,GRDSI7,BCKG
2RD,MIX,ISTAR(24),SLAT,ICLD(24),NMET,NY,ITIME,HEIGHT(200)
COMMON/WND/THETAP,AA,AB
THETAP=450.-THETA(ITIME)
IF(THETAP.GT.360.) THETAP=THETAP-360.
EPSLON=(THETAP-90.)*6.2831853/360.
AA=SIN(EPSLON)
AB=COS(EPSLON)
RETURN
END
WIN00010
WIN00020
WIN00030
WIN00040
WIN00050
WIN00060
WIN00070
WIN00080
WIN00090
WIN00100
WIN00110
WIN00120
WIN00130
WIN00140
WIN00150

```

COMPUTER PROGRAM SOURCE CODE.

ISMAP MODEL

APPENDIX A.

```

C
SUBROUTINE LSLOPE
THIS ROUTINE COMPUTES THE SLOPE AND Y-INTERCEPT OF EACH LINK
COMMON/DISP/XO(200),YO(200),NUMREC,THETA(24),XS(24),YCOEFF(24)
1,YEXP(24),YCONSL,YCONS2,ZCOEFF(24),ZEXP(24),ZCONST,GRDSIZ,RCVG
2PL,MIX,ISTAT(24),SLAT,ICLD(24),NMET,NY,ITIME,HEIGHT(200)
COMMON/LINK/NLINK,NLANE(200),X1(200),Y1(200),X2(200),Y2(200),LCAP(LSL00060
1200),DIST(200),VFL(200),LCON(200,3),NSTOPS(200)
COMMON/LSLOP/AM(200),B(200)
DO 1 I=1,NLINK
CHECK TO SEE IF SLOPE IS INFINITE. IF SO, SET SLOPE AND Y-INTER-
CEPT EQUAL TO ZERO. THIS WILL LE A CUE FOR VERTICAL LINKS.
IF(X1(I).EQ.X2(I)) GO TO 2
AM(I)=(Y1(I)-Y2(I))/(X1(I)-X2(I))
B(I)=Y1(I)-AM(I)*X1(I)
GO TO 1
AM(I)=0.
B(I)=0.
CONTINUE
RETURN
END

```

LSL00010
LSL00020
LSL00030
LSL00040
LSL00050
LSL00060
LSL00070
LSL00080
LSL00090
LSL00100
LSL00110
LSL00120
LSL00130
LSL00140
LSL00150
LSL00160
LSL00170
LSL00180
LSL00190
LSL00200


```

AINSOL=(1.-0.5*ICLD(IHR)/10.)*SINELV(IHR)
IF(AINSOL.LE.0.33) GO TO 21
IF(AINSOL.LE.0.67) GO TO 22
IS=1
GO TO 30
21 IS=3
GO TO 30
22 IS=2
GO TO 30
23 IF(ICLD(IHR).GE.5) GO TO 24
IS=6
GO TO 30
24 IS=5
GO TO 30
25 IS=4
DTERMINE WIND SPEED CLASS
30 IF(WS(IHR).LE.3.) GO TO 31
IF(WS(IHR).LE.6.) GO TO 32
IF(WS(IHR).LE.10.) GO TO 33
IF(WS(IHR).LE.13.) GO TO 34
IA=5
GO TO 40
31 IA=1
GO TO 40
32 IA=2
GO TO 40
33 IA=3
GO TO 40
34 IA=4
DTERMINE STABILITY
C ISTAB(IHR)=ISC(IS,IA)
40 CONVERT WIND SPEED IN KNOTS TO METERS PER SECOND
C WS(IHR)=WS(IHR)*0.514781
41 IF(WS(IHR).LT.1.) WS(IHR)=1.
C DTERMINE DIFFUSION PARAMETERS
KK=ISTAB(IHR)
YCOEFF(IHR)=YC(KK)
YEXP(IHR)=YE(KK)
ZCOEFF(IHR)=ZC(KK)
ZEXP(IHR)=ZE(KK)

```

```

STB00410
STB00420
STB00430
STB00440
STB00450
STB00460
STB00470
STB00480
STB00490
STB00500
STB00510
STB00520
STB00530
STB00540
STB00550
STB00560
STB00570
STB00580
STB00590
STB00600
STB00610
STB00620
STB00630
STB00640
STB00650
STB00660
STB00670
STB00680
STB00690
STB00700
STB00710
STB00720
STB00730
STB00740
STB00750
STB00760
STB00770
STB00780
STB00790
STB00800

```


CONTINUE
RETURN
END

STB000810
STB000820
STB000830

```

SUBROUTINE BASIC
C THIS ROUTINE WILL DETERMINE, ACCORDING TO WIND DIRECTION, WHICH
C LINKS WILL AFFECT THE CONCENTRATION AT THE RECEPTOR AND, FOR THOSE
C LINKS, CALL THE APPROPRIATE ROUTINES TO COMPUTE THE CONCENTRATION
C AT A RECEPTOR
COMMON/DISP/X0(200),Y0(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
1,YEXP(24),YCONSL,YCONSL,YCONSL(24),ZEXP(24),ZCONST,GRDSI7,RCKG
2RD,MIX,ISTAR(24),SLAT,ICLD(24),IMET,NY,ITIME,HEIGHT(200)
COMMON/LINK/NLINK,NLANE(200),X1(200),Y1(200),X2(200),Y2(200),LCAP(BAS00090
1200),DIST(200),VEL(200),LCON(200,3),NSTOPS(200)
COMMON/MAINN/M
COMMON/WND/THETA,AA,AP
COMMON/BASC/I
COMMON/ORIGIN/ALPHA,A,XX,YY
COMMON/STCAN/ISTP(200),AST(200),NLKST(200),WST(200),
8BUILDH(200),RECHGT(200),ISTLIN(200,2),IRSIDE(200)
DIMENSION RK(5)
DATA RK/25.5,5.5,1.75,1.0,0.5/
DO 200 I=1,NLINK
WRITE(6,45)
C 45 FORMAT(/,1X,'INTERMEDIATE RESULTS FROM SUBROUTINE BASIC')
C WRITE(6,46) I,NLINK,M,ISTK(M),NLKST(M)
C 46 FORMAT(1X,'I=',15,1X,'NLINK=',15,1X,'M=',15,1X,'ISTP(M)=' ,15,
C 81X,'NLKST(M)=' ,15)
IF(ISTR(M).CG.0)GOTO 80
NKLDM=NLKST(M)
DO 50 II=1,NKLDM
C WRITE(6,47) I,II,M,ISTLIN(M,II)
C 47 FORMAT(1X,'I=',15,1X,'II=',15,1X,'M=',15,1X,'ISTLIN(M,II)=' ,15)
IF(1.EQ.ISTLIN(M,II))GOTO 55
CONTINUE
50 GOTO 80
55 ISTM=ISTAL(ITIME)
DELTA=7.0*SQRT(RK(ISTM)*WST(M)/
&WS(ITIME))
C WRITE(6,48) M,DELTA,BUILDH(M)
C 48 FORMAT(1X,'M=',15,1X,'DELTA=' ,E12.3,1X,'BUILDH(M)=' ,E12.3)
IF(DELTA.GT.BUILDH(M))GOTO 80
WRITE(6,56)P,I
56 FORMAT(/,1X,'SUBROUTINE SPECT CALLED FOR RECEPTOR',15,1X,'AND ',BAS00400

```

EAS00410
EAS00420
EAS00430
EAS00440
EAS00450
EAS00460
EAS00470
EAS00480
EAS00490
EAS00500
EAS00510
EAS00520
EAS00530
EAS00540
EAS00550
EAS00560
EAS00570
EAS00580
EAS00590
EAS00600
EAS00610
EAS00620
EAS00630
EAS00640
EAS00650
EAS00660
EAS00670
EAS00680
EAS00690
EAS00700
EAS00710

```

8 LINK',15)
CALL STREET
GOTO 200
CONTINUE
EA=X1(I)-X0(M)
EB=X2(I)-X0(M)
EC=Y1(I)-Y0(M)
ED=Y2(I)-Y0(M)
X1TR=EA*AB+EC*AA
X2TR=EB*AB+ED*AA
Y1TR=EC*AB-EB*AA
Y2TR=ED*AB-EB*AA
IF(Y1TR.LT.0.O.AND.Y2TR.LE.0.) GO TO 200
IF(Y1TR.LE.0.) GO TO 1
IF(ABS(ATAN(ABS(Y1TR/X1TR)))) .GE. 45.*6.2831853/360.) GO TO 6
IF(Y2TR.LE.0.) GO TO 100
IF(ABS(ATAN(ABS(Y2TR/X2TR)))) .GE. 45.*6.2831853/360.) GO TO 6
IF(X1TR.LT.0.O.AND.X2TR.LT.0.) GO TO 7
IF(X1TR.LT.0.O.AND.X2TR.LT.0.) GO TO 7
GO TO 200
YONXEQ=Y1TR-((Y1TR-Y2TR)/(X1TR-X2TR))*X1TR
IF(YONXEQ.LT.0.) GO TO 200
CALL OFIGIN
CALL CORTRN
IF(ALPHA.EQ.0.) GO TO 400
CALL CONCA1
GO TO 200
CALL CONCA2
CONTINUE
RETURN
END

```

```

SUBROUTINE ORIGIN
THIS ROUTINE COMPUTES THE COORDINATES (XX,YY) OF POINT TO BE THE
ORIGIN IN NEW COORDINATE SYSTEM AND THE ANGLE FROM THE WIND VECTOR
TO THE LINK
COMMON/DISP/X0(200),Y0(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
1,YEXP(24),YCONSL,YCONS2,ZCOEFF(24),ZEXP(24),ZCONST,GRDS12,BCKG
2RD,MIX,ISTAB(24),SLAT,ICLD(24),NKET,NY,ITIME,HEIGHT(200)
COMMON/LINK/NLINK,NLANE(200),X1(200),Y1(200),X2(200),Y2(200),LCAP(
1200),DIST(200),VFL(200),LCON(200,3),NSTOPS(200)
COMMON/MAINN/M
COMMON/WND/THETAP,AA,AB
COMMON/LSLOP/AM(200),B(200)
COMMON/BASC/I
COMMON/ORIGN/ALPHA,A,XX,YY
C COMPUTE THE POINT OF INTERSECTION (XX,YY) OF LINK (OR ITS EXTEN-
C SION) WITH WIND VECTOR
IF(X1(I).EQ.X2(I)) GO TO 1
IF(THETAP.EQ.90.0.OR.THETAP.EQ.270.) GO TO 2
A=TAN(THETAP*3.14159265/180.)
IF(A.EQ.AM(I)) GO TO 3
XX=(X0(M)*A-Y0(M)+B(I))/(A-AM(I))
YY=AM(I)+XX+B(I)
C COMPUTE ANGLE FROM WIND VECTOR TO LINK, MEASURED COUNTERCLOCKWISE
ALPHA=ATAN2((AM(I)-A),(AM(I)+A+1.))
GO TO 5
C TAKE CARE OF CASES WHERE DENOMINATOR=0
1 IF(THETAP.EQ.90.0.OR.THETAP.EQ.270.) GO TO 4
C IN THIS CASE THE LINK IS PARALLEL TO THE OLD Y-AXIS BUT THE WIND
C IS NOT
XX=X1(I)
A=TAN(THETAP*3.14159265/180.)
YY=(X0(M)-Y0(M))+A+Y0(M)
ALPHA=ATAN2(1.,A)
GO TO 5
C IN THIS CASE THE WIND IS FROM EITHER NORTH OR SOUTH BUT THE LINK
C IS NOT PARALLEL TO IT
XX=X0(M)
YY=AM(I)+X0(M)+B(I)
ALPHA=ATAN2(1.,-AM(I))
GO TO 5

```

```

C
C
C 3 IF(AM(I).EQ.0.) GO TO 11
  AMPRIM=-1./AM(I)
  GO TO 12
11  XX=XO(M)
  YY=Y1(I)
  GO TO 7
12  PPRIME=YO(M)-AMPRIM*XO(M)
  XX=(PPRIME-P(I))/(AM(I)-AMPRIM)
  YY=AM(I)*XX+B(I)
  GO TO 7
C
C IN THIS CASE THE WIND, THE LINK AND THE OLD Y-AXIS ARE ALL
C PARALLEL
4  XX=X1(I)
  YY=YO(M)
  ALPHA=0.
  GO TO 23
C
C THE FOLLOWING STATEMENTS CHECK TO SEE IF THE ANGLE BETWEEN THE
C LINK AND THE WIND VECTOR IS LESS THAN 1 DEGREE--IF SO, THE ANGLE
C IS SET EQUAL TO 0.
5  ZZ=Y1(I)-Y2(I)
  ZZ=X1(I)-X2(I)
  ZETA=(ATAN2(ZZ,ZZ))*.180./PI,14159265
  IF(ZETA.LT.0.) ZETA=360.+ZETA
  IF(ABS(ZETA-THETAP).LT.1.) GO TO 50
  GO TO 23
50  IF(THETAP.EQ.90.0.OR.THETAP.EQ.270.) GO TO 4
  GO TO 7
23  RETURN
  END
  OPI00410
  OPI00420
  ORI00430
  ORI00440
  ORI00450
  ORI00460
  ORI00470
  ORI00480
  ORI00490
  ORI00500
  ORI00510
  ORI00520
  ORI00530
  ORI00540
  ORI00550
  OPI00560
  OPI00570
  ORI00580
  ORI00590
  ORI00600
  ORI00610
  OPI00620
  ORI00630
  ORI00640
  OPI00650
  ORI00660
  ORI00670
  ORI00680
  ORI00690
  ORI00700
  ORI00710

```


APPENDIX A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE.

```

SIGZ=ZCOEFF(I TIME)*A6**ZEXP(I TIME)+ZCONST
A7=Y*A1/SIGY
A8=HEIGHT(I)/SIGZ
A9=0.5*(A7+A7+A8*A8)
IF(A9.GE.88.028) GO TO 100
DO 10 II=1,4
  IF(Y.GT.GAMMA(II)).AND.Y.LE.GAMMA(II+1)) GO TO 3
  IF(Y.GF.GAMMA(II+1)).AND.Y.LT.GAMMA(II)) GO TO 3
  CONTINUE
  CONNOR=CONNOR+0(I,II)/(SIGY*SIGZ*EXP(A9))
  CONTINUE
  CONC(M)=CONC(M)+CONNOR*DELTAY
  RETURN
END

```

ENVIRONMENTAL PROTECTION AGENCY

CN100410
 CN100420
 CN100430
 CN100440
 CN100450
 CN100460
 CN100470
 CN100480
 CN100490
 CN100500
 CN100510
 CN100520
 CN100530
 CN100540

```

SUBROUTINE ZORDR
  THIS ROUTINE KEEPS TRACK OF THE END POINTS OF THE LINKS THAT
  FORM A ZONE--WHICH POINTS ARE OPEN AND WHICH CONNECT. THIS
  IS DONE BECAUSE THE LAST SIDE OF A ZONE MAY NOT BE A LINK. IF IT
  IS NOT, THE OPEN END POINTS OF THE FIRST AND LAST LINKS ARE CON-
  NECTED TO FORM THE LAST SIDE.
  THIS ROUTINE CALLS TWO OTHER SUBROUTINES WHICH FIND THE GRID
  CENTERS THAT LIE IN EACH ZONE.
  DIMENSION XCOORD(2), YCOORD(2), LOE(12), XC(12), YC(12)
  COMMON/DISP/XO(200), YO(200), NUMREC, THETA(24), WS(24), YCOEFF(24)
  1, YEXP(24), YCONS(24), SLAT, ICID(24), MPET, NY, ITIME, HEIGHT(200)
  2RD, KIX, ISTAE(24), SLAT, ICID(24), MPET, NY, ITIME, HEIGHT(200)
  COMMON/LINK/NLINK, NLANE(200), X1(200), Y1(200), X2(200), Y2(200), LCAP(200)
  12(200), LIST(200), VEL(200), LCON(200,3), NSTOPS(200)
  COMMON/ZONES/NZONES, NZLINKS(50), ZLINKS(12,50), ZATTN(50), ZGENR(50),
  1NEXT, ZAT(2), ZGT(2), ZVT(3,50), ZNAME(50), V1(50), V2(50), V3(50),
  1FLL(50)
  COMMON/PARK/PZ, PV(50), PLA(50), V1(50), V2(50), V3(50), PLOS, PLOS(50),
  COMMON/LSLOP/LA(200), B(200)
  COMMON/GNOSC/XGRID(300), YGRID(300), NGRIDX, NGRIDY
  COMMON/ZORP/SLOPE(12), YINCP(12), Y1P, Y2P, Y1P, Y2P, K, J
  COMMON/INERS/INPGL(200), YINT(200,4)
  COMMON/CONCTR/CONC(200)
  COMMON/ZONGSC/ZGSC(50), YZGSC, YZGSC
  COMMON/CONAT/CON(200,50)
  14), CCOUNT(200)
  INTEGER ZLINKS, PLOS
  DO 10 J=1, NZONES
  DO 11 M=1, NUMREC
  CON(M, J)=0.
  IF(G7(J).EQ.0.) GO TO 10
  IF(PNOS(J).GT. 1) GO TO 10
  NGSCZ(J)=0
  GO TO 10
  DO 20 MM=1, NGRIDY
  NPSL(MM)=0
  NOL=PNOS(J)
  DO 16 K=1, NOL
  I=IAPS(ZLINKS(K, J))

```

```

IF(K-2)1,2,3
C STOF END POINTS OF FIRST LINK ON BORDER OF ZONE, THEN CALL
C ROUTINE THAT FINDS INTERSECTIONS OF THE VERTICAL LINES OF GRID
C CENTERS WITH FIRST LINK.
1 XCOORD(1)=X1(I)
XCOORD(2)=X2(I)
YCOORD(1)=Y1(I)
YCOORD(2)=Y2(I)
GO TO 50
C FIND END OF SECOND BORDER LINK THAT CONNECTS TO FIRST LINK. THE
C OTHER END IS OPEN END. THEN CALL INTERSECTION ROUTINE TO MAKE
C CALCULATIONS FOR SECOND LINK.
2 DO 30 LL=1,2
IF(XCOORD(LL).NE.X1(I)) GO TO 31
IF(YCOORD(LL).EQ.Y1(I)) GO TO 32
31 IF(XCOORD(LL).NE.X2(I)) GO TO 33
IF(YCOORD(LL).EQ.Y2(I)) GO TO 34
32 IF(LL.EQ.2) GO TO 101
GO TO 30
32 IF(LL.EQ.2) GO TO 35
LOE(1)=2
LOE(2)=2
GO TO 40
35 LOE(1)=1
LOE(2)=2
GO TO 40
34 IF(LL.EQ.2) GO TO 36
LOE(1)=2
LOE(2)=1
GO TO 40
36 LOE(1)=1
LOE(2)=1
GO TO 40
30 CONTINUE
C FIND OPEN END OF ALL OTHER BORDER LINKS AND CALL INTERSECTION
C ROUTINE FOR EACH OF THESE LINKS
3 IF(XC(K-1).NE.X1(I)) GO TO 43
IF(YC(K-1).EQ.Y1(I)) GO TO 44
43 IF(XC(K-1).NE.X2(I)) GO TO 101
IF(YC(K-1).EQ.Y2(I)) GO TO 46

```

```

44      GO TO 101
      LOE(K)=2
      GO TO 40
46      LOE(K)=1
      STORE COORDINATES OF OPEN (OPEN WITH RESPECT TO PREVIOUS LINK) ENDZB000850
      OF EACH LINK SO THAT THE END OF THE LAST LINK, THAT SHOULD CONNECT
      WITH THE FIRST LINK, CAN BE FOUND.
40      IF(LOE(K).EQ.2) GO TO 41
      XC(K)=X1(I)
      YC(K)=Y1(I)
      GO TO 50
41      XC(K)=X2(I)
      YC(K)=Y2(I)
      STORE SLOPES, Y-INTERCEPTS, AND COORDINATES OF THE ENDS OF EACH
      LINK IN NEW LOCATIONS SO THAT THE SLOPE, INTERCEPT AND COORDINATES
      OF A BORDER SEGMENT THAT IS NOT A LINK (IF IT EXISTS) MAY BE PUT
      IN THE SAME ARRAY.
50      SLOPE(K)=AM(I)
      YINCP(T(K))=B(I)
      X1P=X1(I)
      X2P=X2(I)
      Y1P=Y1(I)
      Y2P=Y2(I)
      FIND POINTS OF INTERSECTION OF VERTICAL LINES OF GRID CENTERS
      WITH LINK
      CALL INTER
      CONTINUE
      CHECK WHETHER FIRST AND LAST BORDER LINKS CONNECT. IF NOT,
      COMPUTE SLOPE AND Y-INTERCEPT OF SEGMENT THAT CONNECTS OPEN ENDS
      OF FIRST AND LAST BORDER LINKS AND SLOPE IN ARRAYS
      LI1=LOF(1)
      IF(XCOORD(LE1).NE.XC(NOL)) GO TO 49
      IF(YCOORD(LE1).EQ.YC(NOL)) GO TO 106
49      AAA=XCOORD(LE1)-XC(NOL)
      IF(AAA.EQ.0.) GO TO 52
      SLOPE(NOL+1)=(YCOORD(LE1)-YC(NOL))/AAA
      YINCP(T(NOL+1))=YC(NOL)-SLOPE(NOL+1)*XC(NOL)
      GO TO 51
52      SLOPE(NOL+1)=0.
      YINCP(T(NOL+1))=0.

```

APPENDIX A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE,

ENVIRONMENTAL PROTECTION AGENCY

```

C      COUNT NUMBER OF SIDES OF ZONE INCLUDING NON-LINK SIDE (IF ONE
C      EXISTS). AND STORE COORDINATES OF END POINTS OF THIS LAST SIDE.
51      I=NCL+1
        X1F=YCOORD(LE1)
        X2F=YC(NOL)
        Y1F=YCOORD(LE1)
        Y2F=YC(NOL)
C      FIND INTERSECTION POINTS FOR SEGMENT
C      CALL INTERS
C      FIND WHICH GRID CENTERS ARE LOCATED IN EACH ZONE
100     CALL ZNGSC
        GO TO 10
101     PRINT 102,ZNAME(J)
102     FORMAT(////,10X,'ZONE ',12,' HAS ILLEGAL BOUNDARY',10X,' CALCULATIZE001340
        TONS OF ARLA SOURCE CONCENTRATIONS FROM THIS ZONE HAVE NOT BEEN MADZ001350
        ZE')
10      CONTINUE
        DO 12 M=1,NUMREC
        DO 13 J=1,NZONES
          IF(NGSCZ(J) .EQ. 0) GO TO 13
          CONC(M)=CONC(M)+CON(M,J)+QZ(J)/NGSCZ(J)
        CONTINUE
        CONTINUE
        RETURN
        END
12
12

```

ZE001210
 ZE001220
 ZE001230
 ZE001240
 ZE001250
 ZE001260
 ZE001270
 ZE001280
 ZE001290
 ZE001300
 ZE001310
 ZE001320
 ZE001330
 ZE001340
 ZE001350
 ZE001360
 ZE001370
 ZE001380
 ZE001390
 ZE001400
 ZE001410
 ZE001420
 ZE001430
 ZE001440
 ZE001450

APPENDIX A.

ISNAP MODEL

RETURN
END

COMPUTER PROGRAM SOURCE CODE.

ENVIRONMENTAL PROTECTION AGENCY

CN200410
CN200420

```

SUBROUTINE XSIGN
THIS ROUTINE FINDS THE SIGN OF THE X-DISTANCE (USED IN THE POINT
SOURCE EQUATION) OF A POINT ON THE LINK OR ITS EXTENSION THAT
WOULD CONTRIBUTE TO THE CONCENTRATION AT THE RECEPTOR IF A SOURCE
WERE LOCATED AT THAT POINT
COMMON/DISP/XO(200),Y0(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
1.YEXP(24),YCONSL,YCONS2,ZCOEFF(24),ZEXP(24),ZCONST,GRDS12,BCKG
2RD,MIX,ISTAE(24),SLAT,ICLD(24),NMET,NY,ITIME,HEIGHT(200)
COMMON/LINK/NLINK,PLANE(200),X1(200),Y1(200),X2(200),Y2(200),LCAP(X
1200),DIST(200),VEL(200),LCON(200,3),NSTOPS(200)
COMMON/MAINN/M
COMMON/WND/THETAP,AA,AB
COMMON/BASC/I
COMMON/ORIGN/ALPHA,A,XX,YY
COMMON/CRTRN/OMEGA,X1NEW,X2NEW,Y1NEW,Y2NEW,XONEW,YONEW
COMMON/CONA1/A1,A2,A3,CONHOR
COMMON/CONCTR/CONC(200)
COMMON/XSGN/A4
C1=XX-XO(M)
C2=YY-YO(M)
IF(C1.EQ.0.0.AND.C2.EQ.0.0) GO TO 9
IF(ALPHA.EQ.0.0) GO TO 12
A4=XONEW/A1
GO TO 10
12 IF(Y1NEW.EQ.YONEW) GO TO 11
IF(THETAP.EQ.90.0.OR.THETAP.EQ.270.0) GO TO 26
IF(A.EQ.0.0) GO TO 13
PLINT=Y1(I)+X1(I)/A
WINDNT=Y0(M)-A*XO(M)
XPERP=A*(PLINT-WINDNT)/(A+A+1.0)
YPERP=A*XPERP+WINDNT
C1=XPERP-XO(M)
C2=YPERP-YO(M)
IF(Y1NEW.NE.YONEW) GO TO 51
A4=Y2NEW
GO TO 10
51 IF(ALPHA.NE.0.0) GO TO 52
A4=Y1NEW
GO TO 10
52 A4=XONEW/A1-Y1NEW*A2

```

```

26      GO TO 10
      C1=0.
      C2=Y1(I)-Y0(M)
      GO TO 51
17      C1=X1(I)-X0(M)
      C2=0.
      GO TO 51
11      IF(THETAP.EQ.90.0.OR.THETAP.EQ.270.) GO TO 27
      IF(A.EQ.0.) GO TO 28
      PWINT=Y2(I)+X2(I)/A
      GO TO 29
27      C1=0.
      C2=Y2(I)-Y0(M)
      GO TO 30
28      C1=X2(I)-X0(M)
      C2=0.
      GO TO 30
9       IF(ALPHA.NE.0.) GO TO 56
      C1=X1(I)-X0(M)
      C2=Y1(I)-Y0(M)
      A4=Y1NEW
      GO AHEAD WITH SIGN CHECK
10      IF(THETAP.EQ.90.) GO TO 20
      IF(THETAP.EQ.270.) GO TO 24
      IF(A.GE.0.0.AND.A.LT.1.0F30) GO TO 101
      IF(THETAP.GT.90.0.AND.THETAP.LE.135.) GO TO 22
      KK=1
      LL=-1
      GO TO 42
22      KK=-1
      LL=1
      GO TO 42
101     IF(THETAP.GT.0.0.AND.THETAP.LE.45.) GO TO 20
24      KK=-1
      LL=-1
      GO TO 42
20      KK=1
      LL=1
      IF POINT IS DOWNWIND OF RECEPTOR, CHANGE SIGN OF A4 SO THAT A4 S
      OF THE SAME SIGN WILL CONTRIBUTE TO CONCENTRATION

```

XSI00410
 XSI00420
 XSI00430
 XSI00440
 XSI00450
 XSI00460
 XSI00470
 XSI00480
 XSI00490
 XSI00500
 XSI00510
 XSI00520
 XSI00530
 XSI00540
 XSI00550
 XSI00560
 XSI00570
 XSI00580
 XSI00590
 XSI00600
 XSI00610
 XSI00620
 XSI00630
 XSI00640
 XSI00650
 XSI00660
 XSI00670
 XSI00680
 XSI00690
 XSI00700
 XSI00710
 XSI00720
 XSI00730
 XSI00740
 XSI00750
 XSI00760
 XSI00770
 XSI00780
 XSI00790
 XSI00800

ENVIRONMENTAL PROTECTION AGENCY

COMPUTER PROGRAM SOURCE CODE

ISMAR MODEL

X A.

XSI00810
XSI00820
XSI00830

42 IF(CCT*KK.LT.O.O.AND.C2*LL.LT.O.) A4=-A6
RETURN
END

```

SUBROUTINE SPCING
C THIS ROUTINE COMPUTES THE DISTANCE TO BE TAKEN BETWEEN POINT
C SOURCES
COMMON/LINK,NLINK,PLANE(200),X1(200),Y1(200),X2(200),Y2(200),LCAP(SPC00040
1200),DIST(200),VEL(200),LCON(200,3),NSTOPS(200)
COMMON/DISP/X0(200),Y0(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
1.YEXP(24),YCONSL,YCONS7,7COEFF(24),ZEXP(24),ZCONST,GRDS17,BCK6
2RD,MIX,ISTAE(24),SLAT,ICLD(24),NMET,NY,ITIME,HEIGHT(200)
COMMON/BASC/I
COMMON/CRTRN/OMEGA,X1NEW,X2NEW,Y1NEW,Y2NEW,XONEW,YONEW
COMMON/SPCIN/DELTAY
IF(Y1NEW.LE.YONEW.AND.YONEW.LE.Y2NEW) GO TO 1
IF(Y2NEW.LE.YONEW.AND.YONEW.LE.Y1NEW) GO TO 1
AEC=ABS(YONEW-Y1NEW)
AED=ABS(YONEW-Y2NEW)
IF(ABC.GT.AED) GO TO 2
DISTNCE=SQRT(AEC*ABC+XONEW*XONEW)
GO TO 3
DISTNCE=ABS(XONEW)
GO TO 3
DISTNCE=SQRT(AED*ABD+XONEW*XONEW)
SGYPRM=YCOEFF(ITIME)*DISTNCE**YEXP(ITIME)
DELTAY=0.1906817*SGYPRM
IF(DELTAY.GE.1.5) GO TO 4
DELTAY=0.160145*(SGYPRM+.7)
IF(DELTAY.GE.1.5) GO TO 4
YCONSL=3.
GO TO 5
YCONSL=DELTAY*.2.
YCL=6.*NLNFI
IF(YCONSL.GT.YCL) YCONSL=YCL
5 RETURN
END
SPC00010
SPC00020
SFC00030
SPC00040
SPC00050
SPC00060
SPC00070
SPC00080
SPC00090
SPC00100
SFC00110
SFC00120
SPC00130
SPC00140
SPC00150
SFC00160
SPC00170
SPC00180
SPC00190
SPC00200
SPC00210
SPC00220
SFC00230
SFC00240
SPC00250
SPC00260
SPC00270
SPC00280
SPC00290
SFC00300
SFC00310
SPC00320
SFC00330

```



```

SUBROUTINE GENGSC
C THIS ROUTINE GENERATES THE COORDINATES OF THE CENTERS OF THE GRID
C SQUARES THAT OVERLAY THE INDIPECT SOURCE. THE GRID OVERLAY IS
C USED IN CALCULATING CONCENTRATIONS RESULTING FROM ZONE AREA
C SOURCES.
C THE USER HAS THE OPTION OF SPECIFYING A GRID SIZE OR USING THE
C DEFAULT VALUE OF 10 METERS.
C COMMON/DISP/XO(200),YO(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
1 YEXP(24),YCONSL,YCONS7,7COEFF(24),ZEXP(24),ZCONST,GRDSIZ,BCKG
2 RD,MIX,ISTAE(24),SLAT,ICLD(24),NMET,NY,ITIME,HEIGHT(200)
C COMMON/LINK/NLINK,NLANF(200),X1(200),Y1(200),X2(200),Y2(200),LCAP(GEN00110
1200),DIST(200),VFL(200),LCON(200,3),NSTOPS(200)
C COMMON/GNGSC/XGRID(300),YGRID(700),NGRIDX,NGRIDY
XMAX=X1(1)
YMAX=Y1(1)
DO 1 I=1,NLINK
XPA=APAX1(XMAX,X1(I),X2(I))
YPA=APAX1(YMAX,Y1(I),Y2(I))
CONTINUE
IF(GRDSIZ.EQ.0.) GRDSIZ=10.
NGRIDX=XMAX/GRDSIZ+1.999
NGRIDY=YMAX/GRDSIZ+1.999
DO 3 NN=1,NGRIDX
XCPID(MM)=0.05+(MM-1)*GRDSIZ
DO 4 NN=1,NGRIDY
YGRID(NN)=0.05+(NN-1)*GRDSIZ
YCONS7=GRDSIZ
RETURN
END

```

```

C
C
C
SUBROUTINE INTER
THIS ROUTINE FINDS THE POINTS OF INTERSECTION OF THE VERTICAL
LINES OF GRID CENTERS WITH THE LINK AND STORES THEM IN AN ARRAY
TO BE OPERATED ON BY SUBROUTINE ZNGSC.
COMMON/6NGSC/XGRID(300),YGRID(300),NGRIDX,NGRIDY
COMMON/ZEORFF/SLOPE(12),YINCP(12),X1P,X2P,Y1P,Y2P,K,J
COMMON/INERS/NPGL(300),YINT(300,4)
IF(SLOPE(K).EQ.0.0.AND.YINCP(K).EQ.0.) GO TO 1
DO 2 NM=1,NGRIDX
X=XGRID(NM)
IF(X1P.GT.X2P) GO TO 3
IF(X.GT.X1P.AND.Y.LT.X2P) GO TO 4
GO TO 2
IF(X.GE.X1P.OR.X.LE.X2P) GO TO 2
Y=SLOPE(K)*X+YINCP(K)
NPGL(NM)=NPGL(NM)+1
NSTAR=NPGL(NM)
YINT(NM,NSTAR)=Y
CONTINUE
RETURN
END

```

```

INT00010
INT00020
INT00030
INT00040
INT00050
INT00060
INT00070
INT00080
INT00090
INT00100
INT00110
INT00120
INT00130
INT00140
INT00150
INT00160
INT00170
INT00180
INT00190
INT00200
INT00210

```

APPENDIX A.

ISPAP MODEL

COMPUTER PROGRAM SOURCE CODE.

ENVIRONMENTAL PROTECTION AGENCY

```

SUBROUTINE ZNGSC
C THIS ROUTINE DETERMINES WHICH GRID CENTERS FALL IN EACH ZONE
C THIS IS DONE BY FINDING WHICH GRID SQUARE CENTERS ON EACH VERTICAL
C LINE OF THEM FALL BETWEEN THE POINTS WHERE THE VERTICAL LINE
C INTERSECTS THE ZONE BORDER LINKS
C DIMENSIONARY(4)
C COMMON/ZONES/NZONES,NZLINKS(50),ZLINKS(12,50),ZATTR(50),ZGENR(50),
C COMMON/GNGSC/XGRID(300),YGRID(200),NGRIDX,NGRIDY
C COMMON/ZBORR/SLOPE(12),YINCP(12),X1P,X2P,Y1P,Y2P,K,J
C COMMON/INERS/NPGL(100),YINT(300,4)
C COMMON/ZONGSC/NGSCZ(50),XZGSC,YZGSC
C NGSCZ(J)=0
C DO 1 NY=1,NGRIDX
C NSTAR=NPGL(MM)
C IF(NSTAR.EQ.0) GO TO 1
C GO TO(2,3,2,3),NSTAR
C THESE STATEMENTS PUT INTERSECTION POINTS ON EACH VERTICAL GRID
C CENTER LINE IN AN ARRAY IN DESCENDING NUMERICAL ORDER OF THEIR
C VALUES
C NF=1
C NI=NSTAR
C DO 20 KOO=1,NSTAR
C DO 4 L=1,NI
C DO 5 LP=1,NI
C IF(YINT(MM,L).LT.YINT(MM,LP)) GO TO 4
C IF(LP.LT.NI) GO TO 5
C ARY(NF)=YINT(MM,L)
C GO TO 6
C CONTINUE
C CONTINUE
C IF=0
C DO 7 L=1,NI
C IF(YINT(MM,L).EQ.ARY(NF)) GO TO 7
C IF=IP+1
C YINT(MM,IP)=YINT(MM,L)
C CONTINUE
C NI=NI-1
C NF=NF+1
C CONTINUE
20

```



```

SUBROUTINE CONCA7
C THIS ROUTINE CALCULATES THE CONTRIBUTION FROM ZONES (AREA SOURCES)
C TO THE CONCENTRATION AT THE RECEPTOR AND ADDS IT TO THE LINK
C CONTRIBUTIONS
COMMON/DISP/XO(200),YO(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
1,YEXP(24),YCONSL,YCONS2,ZCOEFF(24),ZEXP(24),ZCONST,GRDS17,BCKG
2RD,MIX,ISTAB(24),SLAT,ICLD(24),NMET,NY,ITIME,HEIGHT(200)
COMMON/ZEORR/SLOPE(12),VINCPT(12),X1P,X2P,Y1P,Y2P,K,J
COMMON/ZCHCK/XZTR,YZTR,M
COMMON/CONA3/CON(200,50)
COMMON/EXCLUD/NOPARK
SIGY=YCOEFF(ITIME)*YZTR*YEXP(ITIME)+YCONS2
IF(ZCONST.LT.3.) ZCONST=7.
SIGZ=ZCOEFF(ITIME)*YZTR*ZEXP(ITIME)+ZCONST
D=(D.5*XZTR*XZTR)/(SIGY*SIGY)
IF(D.GE.100.) GO TO 1
IF(NOPARK.EQ.1)GOTO 1
CON(M,J)=CON(M,J)+1./ (SIGY*SIGZ*EXP(D))
RETURN
END

```

1

```

C
SUBROUTINE PRNTOUT
THIS ROUTINE PRINTS THE MODEL RESULTS
COMMON/DISP/XO(200),YO(200),NUMREC,THETA(24),WS(24),YCOEFF(24)
1,YEXP(24),YCONS1,YCONS2,YCOEFF(24),ZEXP(24),ZCONST,GRDS1Z,BCKG
2RD,MIX,ISTAE(24),SLAT,ICLD(24),NMET,NY,ITIME,HEIGHT(200)
COMMON / COMM / I,Z,L,J,K,TOD,DOP,TP,TOTATT,ITPZ,ITGTGEN,ITM
1,NYEAR,LHEAD(18),TUNFAC
COMMON/LINK/NLINK,NLANE(200),X1(200),Y1(200),X2(200),Y2(200),LCAP(PRN00080
1200),DIST(200),VEL(200),LCON(200,3),NSTOPS(200)
COMMON/ZONES/NZONES,NZLINS(50),ZLINKS(12,50),ZATTR(50),ZGENK(50),
1NEXT,ZAT(2),ZGT(2),ZVT(3,50),ZNAME(50)
COMMON / INTRST/ NINS, LIN(70,4),ITYPC (70), CYCL(70), PH(70,4),
1 CI(70), GCAP(70,4), QUE(70,4)
COMMON/CONCTR/CONC(200)
PRINT 21,LHEAD,NYEAR
21 FORMAT(1H1,47X,'INDIRECT SOURCE MODEL OF AIR POLLUTION'/////.5X,18PRN00160
1A4,10X,'DATE =',I6/)
PRINT 22,NLINK,NZONES,NINS
22 FORMAT(22X,'NO. OF LINKS =',I3,10X,'NO. OF ZONES =',I5,10X,'NO.
1OF INTERSECTIONS =',I5/////)
PRINT 43,TOD,THETA(ITIME),WS(ITIME),ISTAR(ITIME)
43 FORMAT(10X,'HOUR =',F5,0,1X,'WIND DIRECTION =',F5,0,8X,'WIND SPEPRN00220
1ED =',F10,1,8X,'STABILITY =',I6////)
PRINT 45
45 FORMAT(1X,8HRECEPTOR,49X,'CO CONCENTRATION (PPM)'////)
MM=NUMREC/10.+1.01
DO 40 L=1,MM
L2=L*10
L1=L2-9
IF(L.EQ.MM) L2=NUMREC
PRINT 46,L1,L2,(CONC(M),M=L1,L2)
46 FORMAT(1H 13,2H -,I3,1X,10(2X,1PE10,2))
CONTINUE
RETURN
END
PRN00010
PRN00020
PRN00030
PRN00040
PRN00050
PRN00060
PRN00070
PRN00080
PRN00090
PRN00100
PRN00110
PRN00120
PRN00130
PRN00140
PRN00150
PRN00160
PRN00170
PRN00180
PRN00190
PRN00200
PRN00210
PRN00220
PRN00230
PRN00240
PRN00250
PRN00260
PRN00270
PRN00280
PRN00290
PRN00300
PRN00310
PRN00320
PRN00330
PRN00340
PRN00350

```

```

      SUEKROUTINE STREET
      COMMON/LINK/NLINK,MLANE(200),X1(200),Y1(200),X2(200),
      &Y2(200),LCAP(200),DIST(200),VEL(200),LCON(200,3)
      COMMON/DISP/XO(200),YO(200),NUMREC,THETA(24),WS(24),YCOEFF(24),
      &YEAR(24),YCONSL,YCONS2,ZCDEFF(24),ZEXP(24),ZCONST,GRDSIZ,
      &BCKGRD,MIX,ISTAB(24),SLAT,ICLD(24),IMET,NY,ITIME,
      &HEIGHT(200)
      COMMON/STCAN/ISTR(200),AST(200),NLKST(200),WST(200),
      &BUILDH(200),RECHGT(200),ISTLIN(200,2),IRSIDE(200)
      COMMON/MAINN/M
      COMMON/BASC/I
      COMMON/CONCTR/CONC(200)
      COMMON TT(200,3),DFLA(200,3),GZ(50),QUFUE(200),G(200,4),
      &PLINK(200,4),CCOUNT(200)
      DIMENSION DX(4),DY(4),XX(4),YY(4)
      CONVERT STREET WIDTH, BUILDING HEIGHT AND PECEPTOR HEIGHT TO
      METERS
      W=WST(M)
      BHT=BUILDH(M)
      PHT=RECHGT(M)
      CK=7.0
      XLD=2.
      WRITE(6,5) M,I,W,BHT,PHT,XLO
      FORMAT(1X,M=,15,1X,I=,15,1X,W=,F10.2,1X,PHT=,F10.2,
      &1X,PHT=,F10.2,1X,XLO=,F10.2)
      DETERMINE WHICH SEGMENT OF THE LINK CONTRIBUTES MOST
      STRONGLY TO THE STREET CANYON RECEPTOR
      DX=X2(I)-X1(I)
      DY=Y2(I)-Y1(I)
      SL=SQRT(DX**2+DY**2)
      WRITE(6,6)M,I,DX,DY,SL
      FORMAT(1X,M=,15,1X,I=,15,1X,DX=,F10.2,1X,DY=,F10.2,1X,
      &SL=,F10.2)
      DO 10 II=1,4
      DX(II)=(DLINK(I,II)/SL)*DX
      DY(II)=(DLINK(I,II)/SL)*DY
      WRITE(6,12)M,I,II,DX(II),DY(II)
      FORMAT(1X,M=,15,1X,I=,15,1X,II=,15,1X,DX(II)=,F10.2,
      &1X,DY(II)=,F10.2)
      CONTINUE
10

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```

STR00010
STR00020
STR00030
STR00040
STR00050
STR00060
STR00070
STR00080
STR00090
STR00100
STR00110
STR00120
STR00130
STR00140
STR00150
STR00160
STR00170
STR00180
STR00190
STR00200
STR00210
STR00220
STR00230
STR00240
STR00250
STR00260
STR00270
STR00280
STR00290
STR00300
STR00310
STR00320
STR00330
STR00340
STR00350
STR00360
STR00370
STR00380
STR00390
STR00400

```

```

20      XX(1)=DX(1)/2.+X1(I)
      YY(1)=DY(1)/2.+Y1(I)
      DO 20 JJ=2,4
      XX(JJ)=XX(JJ-1)+DX(JJ-1)/2.+DX(JJ)/2.
      YY(JJ)=YY(JJ-1)+DY(JJ-1)/2.+DY(JJ)/2.
      CONTINUE
      DTEST=1.OE+8
      DO 30 JJ=1,4
      DTS=SQRT((XX(JJ)-XO(M))*2+(YY(JJ)-YO(M))*2)
      WRITE(6,22) JJ,M,XX(JJ),YY(JJ),XO(M),YO(M),DTS
22      FORMAT(1X,'JJ=',I5,1X,'M=',I5,1X,'XX(JJ)=-',E12,3,'/0.1X,
      8'YY(JJ)=-',E12,3,1X,'YO(M)=-',E12,3,1X,'YO(M)=-',E12,3,'/0.
      81X,'DTS=-',E12,3)
      IF(DTS.LT.DTEST)GOTO 25
      GOTO 30
25      DTEST=DTS
      JKEEP=JJ
      CONTINUE
      WRITE(6,32) I,JKEEP,O(I,JKEEP)
32      FORMAT(1X,'I=',I5,1X,'JKEEP=-',I5,1X,'O(I,JKEEP)=-',F12,3)
      CV=CK*2(I,JKEEP)+(PHT-RHT)/(W*(WS(ITIME)+0.5)*EHT)
      CL=CK*O(I,JKEEP)/(CWS(ITIME)+0.5)*(SQRT((W/2.))*2+RHT**2)+XL0))
      WRITE(6,35)M,I,JKEEP,CN,CL
35      FORMAT(1X,'M=-',I5,1X,'I=-',I5,1X,'JKEEP=-',I5,1X,'CN=-',E12,3,1X,
      8'CL=-',E12,3)
      EPSIL=THETA(ITIME)-AST(M)
      WRITE(6,40)M,I,EPSIL
40      FORMAT(1X,'M=-',I5,1X,'I=-',I5,1X,'EPSIL=-',F10,2)
      IF(EPSIL.LT.0.)EPSIL=360.+EPSIL
      IF(EPSIL.GT.30..AND.EPSIL.LE.150..AND.IRSIDE(M).EQ.1) GO TO 50
      IF(EPSIL.GT.30..AND.EPSIL.LE.150..AND.IRSIDE(M).EQ.2) GO TO 60
      IF(EPSIL.GT.210..AND.EPSIL.LE.330..AND.IRSIDE(M).EQ.1) GO TO 60
      IF(EPSIL.GT.210..AND.EPSIL.LE.330..AND.IRSIDE(M).EQ.2) GO TO 50
      CONC(M)=CONC(M)+((CL+CN)/2.)*3.14159265*WS(ITIME)
      GOTO 100
50      CONC(M)=CONC(M)+(CL+3.14159265*WS(ITIME)
      GOTO 100
60      CONC(M)=CONC(M)+(CN+3.14159265*WS(ITIME)
100     CONTINUE
      RETURN

```


INI00410
INI00420
INI00430
INI00440
INI00450

```
C      R(TF(I1,1),I1=1,20).(DEC(I1),I1=1,20)
C 200  FORMAT (60(1X,4E15.8/),-1-/20(1X,F15.5/),
C      R-1-/60(1X,4F15.8/),-1-/20(1X,F15.5/))
      RETURN
      END
```

CRU000010
 CRU000020
 CRU000030
 CRU000040
 CRU000050
 CRU000060
 CRU000070
 CRU000080
 CRU000090
 CRU000100
 CRU000110
 CRU000120
 CRU000130
 CRU000140
 CRU000150
 CRU000160

```

SUBROUTINE CRUZ(V,FMCRUZ)
COMMON/AGEMM/DEC
COMMON/COCOEF/COEF
DIMENSION COEF(20,12),DEC(20),X(12)
FMCRUZ=0.
X(10)=1.
X(11)=V
X(12)=V**2
DO 100 I1=1,20
  IF(DEC(I1).EQ.0.) GO TO 100
  DO 50 I2=10,12
    EMCRUZ=FMCRUZ+X(I2)*COEF(I1,I2)+DEC(I1)
  50 CONTINUE
  100 CONTINUE
  RETURN
END

```

```

SUBROUTINE ACDC(V,A,EMAD)
COMMON/AGEMP/DEC
COMMON/COEFF/COFF
DIMENSION COEF(20,12),DEC(20),X(12)
EMAD=0.
IPRSH=0
AMAX=1.0
AMIN=-1.2
A1=-1.0/AMIN
A2=-1.0/AMAX
IF(A.EQ.0.) GO TO 200
T=ABS(V/A)
AA=A*A
TT=T*T
X(1)=T
X(2)=A*TT/2.0
X(3)=A*T
X(4)=AA*TT/2.0
X(5)=AA*TT*T/7.0
X(6)=AA*T
X(7)=AA*A*TT*T/3.0
X(8)=AA*A*TT/2.0
X(9)=AA*AA*TT*T/7.0
X(10)=X(1)
X(11)=X(2)
X(12)=X(5)
IF(A.GE.AMAX) HOA=0.
IF(A.LE.AMIN) HOA=0.
IF(A.GE.0.0.AND.A.LT.A1*A2) HOA=(A2*A)+1.0
IF(A.LE.0.0.AND.A.GT.A1*A2) HOA=(A1*A)+1.0
SOA=1.-HOA
DO 100 I1=1,20
IF(DEC(I1).EQ.0.) GO TO 100
DO 70 I2=1,6
IF(A.LT.0.0.AND.I2.EQ.2) GO TO 50
IF(A.LT.0.0.AND.I2.EQ.4) GO TO 50
IF(A.LT.0.0.AND.I2.EQ.7) GO TO 50
EMAD=EMAD+X(I2)*SOA*COEF(I1,I2)*DEC(I1)
GO TO 65
50 EMAD=EMAD-X(I2)*SOA*COEF(I1,I2)*DEC(I1)

```



```

65 IF (IPRSM-GE.1) WRITE(6,9020) EMAD,I1,I2
9020 FORMAT (10X,'EMAD =',F12.3,2I5)
70 CONTINUE
DO 20 I2=10,12
IF(A.LT.0.0.AND.I2.EQ.11) GO TO 75
EMAD=EMAD+X(I2)*HOA*COEF(I1,I2)*DEC(I1)
GO TO 80
75 EMAD=EMAD-X(I2)*HOA*COEF(I1,I2)*DEC(I1)
80 CONTINUE
100 CONTINUE
GO TO 250
200 EMAD=0.
250 CONTINUE
EMAD=EMAD/T
RETURN
END
ACD00410
ACD00420
ACD00430
ACD00440
ACD00450
ACD00460
ACD00470
ACD00480
ACD00490
ACD00500
ACD00510
ACD00520
ACD00530
ACD00540
ACD00550
ACD00560

```

```

C
      SLEFOURTH SUPS (IRIFLG,T1,12,A1,X1,X2,X3,X4,A21,A22,A23,
      &A24,A25,A26,15,16,17,EMCPU7,ENIDLE)
      COMMON/FLGCOM/ALTFLG,ALHFLG,TRKFLG,IPDFLG,SP3FLG,NMHFLG,IDLFLG,
      * UNFFLG,MYMFFG,IMFLG,ICEVFG,PRTFLG,IFORM
      COMMON/REGCOM/IREJN
      COMMON/LNKCOM/SPD,TEMP,PCCO,PCHS,PCCC,VMTMIX
      COMMON/ALTCOM/NMYALT,ALTMOD
      COMMON/MYNCON/MYP,MYP,MYP,TF
      COMMON/JUNK1/AC,XLOAD,TRAILR,ABSHUN
      COMMON/JUNK2/HGWT,HWT,HGWT,HGWT,HGWT,HGWT
      COMMON/PROJCM/PROJID
      COMMON/IMCOM/ICVIM,ISTPIN,INTFLG,MODYR1,MODYR2
      COMMON/SP1CON/SP1,SPAV
      INTEGER ALHFLG,TRKFLG,ALTFLG,ALTMOD(4,20),CY,VMFLAG,SP3FLG,
      * NMHFLG,IDLFLG,UNFFLG,PRTFLG
      REAL SPD(3),VMTMIX(6),MYN(20,6),MYR(20,6),TF(20,6)
      REAL EFPEIM(3,6),WTEDEF(2),LNKDATA(7),PROJID(20)
      EQUIVALENCE (SPD(1),LNKDATA(1))
      DATA VMTMIX/.503,.058,.058,.045,.031,.005/
      DATA IREAD,IVRI/5,4/
      REAL COMCCC(6),IDLEIM(4,2),IDLEIM(7)
      DATA IPJOLD/0/

      IREJN=11
      CY=12
      TEMP=X1
      PCCO=X2
      PCHS=X3
      PCCC=X4
      VMTMIX(1)=A21
      VMTMIX(2)=A22
      VMTMIX(3)=A23
      VMTMIX(4)=A24
      VMTMIX(5)=A25
      SUP00010
      SUP00020
      SUP00030
      SUP00040
      SUP00050
      SUP00060
      SUP00070
      SUP00080
      SUP00090
      SUP00100
      SUP00110
      SUP00120
      SUP00130
      SUP00140
      SUP00150
      SUP00160
      SUP00170
      SUP00180
      SUP00190
      SUP00200
      SUP00210
      SUP00220
      SUP00230
      SUP00240
      SUP00250
      SUP00260
      SUP00270
      SUP00280
      SUP00290
      SUP00300
      SUP00310
      SUP00320
      SUP00330
      SUP00340
      SUP00350
      SUP00360
      SUP00370
      SUP00380
      SUP00390
      SUP00400

```

```

VMTMIX(6)=A26
ALHFLG=15
TEKFLG=16
IMFLG=17
SPD(1)=A1
SPD(2)=A1
SPD(3)=A1

C
C
IF(INIFLG.EQ.0) GO TO 100
MYMRFG=0
MSFLG=1
ALTFLG=0
SP3FLG=1
NMHFLG=0
IDLFLG=1
UNFFLG=0
ICEVFG=1
IFORM=1
PRTFLG=0
IPRTSW=0
INFLG=0
IF(MYMRFG.EQ.1) READ(2,50) MYM,MYR
50 FORMAT(20F4.1)
CALL TFCALX
100 CONTINUE
C
C**CHECK CALENDAR YEAR
IF(CY.GE.70) GO TO 505
WRITE(IWRI,785)
785 FORMAT(' ***ERROR: CALENDAR YEAR RANGE IS 70 THRU 99')
STOP
505 CONTINUE
ICYPR = CY
IF(CY.GT.95) CY = 95
C
C**CHECK AMBIENT TEMPERATURE
IF(TEMP.GE.0.0.AND.TEMP.LE.110.) GO TO 697
WRITE(IWRI,787)
787 FORMAT(' ***ERROR: VALID TEMPERATURE RANGE IS 0-110 DEG.(F)')
SUP00410
SUP00420
SUP00430
SUP00440
SUP00450
SUP00460
SUP00470
SUP00480
SUP00490
SUP00500
SUP00510
SUP00520
SUP00530
SUP00540
SUP00550
SUP00560
SUP00570
SUP00580
SUP00590
SUP00600
SUP00610
SUP00620
SUP00630
SUP00640
SUP00650
SUP00660
SUP00670
SUP00680
SUP00690
SUP00700
SUP00710
SUP00720
SUP00730
SUP00740
SUP00750
SUP00760
SUP00770
SUP00780
SUP00790
SUP00800

```



```

657 STOP
658 CONTINUE
C
C*(CHECK INPUT SPEED(S)
  IF(SF3FLG.EQ.1) GO TO 659
  IF(SP1.GT.0.) GO TO 620
  WRITE(IWRI,786)
  FORMAT(' ***ERROR: SPEED MUST BE POSITIVE')
  STOP
620 IF(SP1.GT.60.) SP1 = 60.
  IF(SP1.LT.5.) WRITE(IWRI,788)
  FORMAT(' **WARNING: AVG. ROUTE SPEED LESS THAN 5 M.P.H.')
  GO TO 695
C
650 CONTINUE
  IF(SPD(1).GT.0.0.AND.SPD(2).GT.0.0.AND.SPD(3).GT.0.0.) GO TO 670
  WRITE(IWRI,786)
  STOP
  CONTINUE
  DO 571 I=1,3
  IF(SPD(I).LT.5.) WRITE(IWRI,788)
  IF(SPD(I).GT.60.) SPD(I) = 60.
671
C
695 CONTINUE
C**END SPEED CHECK
C
  IF(SF3FLG.EQ.1) GO TO 620
  C**HERE TO DECOMPOSE SINGLE ENTERED SPEED INTO EAG SPEEDS
  SPD(1) = SP1*.30
  SPD(2) = SP1*.25
  SPD(3) = SP1*.30
  SPD(1) = SP1
  SPD(2) = SP1
  SPD(3) = SP1
  SPD(1) = SP1*(1.3777288 - (PCCC*.30/79.42))
  SPD(2) = SP1*(.7975 + (PCHS*.175/72.72))
  SPD(3) = SPD(1)
C
C PCHSNC = PCCC - PCCO + PCHS
C

```

APPENDIX A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE.

ENVIRONMENTAL PROTECTION AGENCY

```

C
C      PCHSTB = 100. - PCCC - PCHC
C      SPD(1) = SP1*(1.41114406 - .0041114406*PCCC)
C      SPD(2) = SP1*(.6162276024 + .003837724*PCHSTB)
C      SPD(3) = SP1*(1.44002449 - .0044902449*PCHSNC)
C      CONTINUE
C
C      IF(CIREJN.NE.IRJOLD) CALL INITEX(NMYALT,ALTY00)
C      IF(CIREJN.NE.IPJOLD.AND.I'FLG.EQ.1) CALL LDVIMX
C      IRJOLD=IFEJN
C      CALL EFCALX(CY,LNKDTA,VMTMIX,EFRETM,WTEDEF,COMCCC,IDLRTM,IDLWTD,
C      &INIFLG)
C      IF(IPTRTSW.EQ.1) CALL OUTPUT(ICYPR,EFRETM,WTEDEF,COMCCC,IDLRTM,
C      &IDLWTD)
C      EMCRUZ=WTEDEF(2)
C      EMIDLE=IDLWTD(2)
C      RETURN
C      END

```

SUP01210
SUP01220
SUP01230
SUP01240
SUP01250
SUP01260
SUP01270
SUP01280
SUP01290
SUP01300
SUP01310
SUP01320
SUP01330
SUP01340
SUP01350
SUP01360
SUP01370
SUP01380

```

C
SUBROUTINE OUTPUT(CY,EFRFTN,WTEDEF,COMCCC,IDLKTM,IDLWTD)
COMMON/FLGCOM/ALTFLG,ALHFLG,TRKFLG,IPDFLG,SPZFLG,MWHFLG,IDLFLG,
* UNFFLG,MYMPFG,IMHFLG,ICEVFG,PRTFLG,IFORM
COMMON/REGCOM/IREJN
COMMON/BEFCOM/BEF
COMMON/LNKCOM/SPD,TEMP,PCCO,PCHS,PCCC,VMTMX
COMMON/ALTCOM/NMYALT,ALTOD
COMMON/MYCOM/MYM,MYR,TF
COMMON/JUNK1/AC,XLOAD,TRAILR,ABSHUM
COMMON/JUNK2/HGWGT,HDCID,HDCID
COMMON/RET1/ALHRET
COMMON/RET2/TRKRET(20,3,2)
COMMON/IMCOM/ICYIN,ISTRIP,IMTFLG,MODYR1,MODYR2
COMMON/SP1COM/SP1,SPAV

INTEGER ALHFLG,TRKFLG,ALTFLG,ALTOD(4,20),CY,VMFLAG,SPZFLG,
NMHFLG,IDLFLG,UNFFLG,MYMPFG,PRTFLG
* VMTMX(6),MYM(20,6),MYR(20,6),PNAM1(3),PNAM2(3),PNAM3(3)
REAL SPD(3)
REAL EVPNAM(3),EYHADR(9),IDLNM1(3),IDLNM2(3),IDLNM3(3)
REAL IDLRMT(3,6),IDLWTD(7),PNAMH(2)
REAL IDLHADR(4),IDLH2(4),RFGN1(3),REGN2(3)
REAL COMPEF(20,3,6)
REAL ALHRET(20,4,3)
REAL A(20,3,3),U(20,3,3),L(3,3),H(3),XLOAD(3)
REAL EFRFTM(3,6),WTEDEF(7),LNKDATA(7),PROJID(20)
REAL COMCCC(6),TF(20,6)
REAL BEF(20,26,3,6)
REAL YESNO(2)
EQUIVALENCE (SPD(1),LNKDATA(1))

DATA PROJID/EMIS,SION,FAC,TOR,CALC,
ULAT,ION,SURR,OUTI,
NE,SUP8,(MOD,ILE1,PRO,
GFAM,MOD,IFIE,0)
DATA PNAMH/NON,METH/
DATA PNAM1/T,EXHA,EXHA/
DATA PNAM2/TOTAL,UST,UST/
DATA PNAM3/HC,CO,NOX/

```

```

DATA IDLNM1/' ' I' I' I'
DATA IDLNM2/'DLE' 'DLE' 'DLE'
DATA IDLNM3/'HC' 'CO' 'NOX'
DATA EVFNAM/' ' 'EVAP' 'HC'
DATA IWRI,IWRUNF/6.9/
DATA EXHHR/'COMP' 'OSIT' 'E' 'EM' 'ISSI' 'ON F' 'ACTO'
DATA RS ('GM/M' 'ILE)/
* DATA IDLHDR/'IDLE' 'EMI' 'SSIO' 'N FA' 'CTOR' 'S (G'
* 'M/MI' 'N)
DATA IDLMD2/' ' 'CO' 'RREC' 'TED' /
DATA REGN1/'49-S' 'CALI' 'HI-A'
DATA REGN2/'TATE' 'F' 'LT'
DATA DASH/'-----'
DATA INITFL/1/
DATA YESNO/'NO' 'YES' /
*****
C**
C**
IF(NMHFLG.EQ.0) GO TO 77
PNAM1(1) = PNAMH(1)
PNAM2(1) = FNAMEH(2)
CONTINUE
77
C
IF(INITFL.NE.1) GO TO 175
C**HERE FIRST TIME
INITFL=0
IF(IFORM.EQ.0) WRITE(IWRI,7011) PROJID
IF(IFORM.EQ.1) WRITE(IWRI,7011) PROJID
IF(IFORM.EQ.1)
*WRITE(IWRI,7017) PNAM1(1),PNAM2(1),PNAM3(1)
FORMAT('O',2X,'A',2A4,A3,'EMISSION FACTORS INCLUDE ',
7017 * 'EVAP' 'HC EMISSION FACTORS')
C
IF(IFORM.EQ.1) WRITE(IWRI,710)
CONTINUE
175
C
IF(IFORM.EQ.0) GO TO 692
C**
C**
WRITE(IWRI,7029)
IF(SF3FLG.EQ.1)

```

```

*WRITE(IWPI,703) CY,TEMP,VNTNIX,FEGN1(IPEJN),REGM2(IREJN),SPD,SPAV,OUT00810
* FCO,PCHS,PCCC OUT00820
IF(SP3FLG.EQ.0) OUT00830
*WRITE(IWPI,7035) CY,TEMP,VNTNIX,RECN1(IREJN),REGM2(IREJN),SP1,SPD,OUT00840
* SPAV,PCCO,PCHS,PCCC OUT00850
IF(ALHFLG.EQ.1) WRITE(IWPI,704) AC,XLOAD,TFAILR,AESHUM OUT00860
IF(TRKFLG.EQ.1) WRITE(IWPI,705) HGWT,HGWT,HGCTID,HGCTID OUT00870
IF(IMFLG.EQ.1) WRITE(IWPI,7051) ICYIM,ISTRIN,YESNO(IMTFLG+1) OUT00880
IF(IMFLG.EQ.1) WRITE(IWPI,7052) MODYR1,MODYR2 OUT00890
WRITE(IWPI,7059) EYHHR OUT00900
WRITE(IWPI,706) OUT00910
OUT00920
OUT00930
OUT00940
OUT00950
OUT00960
OUT00970
OUT00980
OUT00990
OUT01000
OUT01010
OUT01020
OUT01030
OUT01040
OUT01050
OUT01060
OUT01070
OUT01080
OUT01090
OUT01100
OUT01110
OUT01120
OUT01130
OUT01140
OUT01150
OUT01160
OUT01170
OUT01180
OUT01190
OUT01200

```

```

      IF(PRTFLG.EQ.0) IPP2=7
      DC 1207 IPNX=IPP1,IPF2
      WRITE(IWRI,75050) IREJN,CY,SPD,TEMP,PCCO,PCHS,FCCC,IPNX,
      * (EFRETM(IPNX,IM),IM=1,6),VMTMIX,WTEDEF(IPNX)
1203  CONTINUE
79080 FORMAT(1X,I1,1X,I2,1X,I3,1X,F4.1,1X,F4.1,1X,F4.1,1X,
      * F3.0,1X,F5.1,1X,F5.1,1X,F5.1,1X,I1,6F6.1,6F6.3,7F7.2)
      C
899  CONTINUE
      C
      C
      C*****
      C
      IF(UNFFLG.EQ.1) WRITE(IWRUNF) EFRETM,WTEDEF
      C
      C*****
      C
      701  FORMAT('1',20A4/)
      7011 FORMAT('1',20A4)
      C
      7029 FORMAT(32X,'VEH. TYPE: LDV LDT1 LDT2 HDG HDD MC')
      C
      707  FORMAT(' CAL. YEAP: 19',I2,5X,'TEMP: ',F4.1,
      * '(F)',8X,5(F5.3,1X),F5.7,
      * /1X,' REGION: ',2A4,4X,F4.1,1X,F4.1,1X,F4.1,
      * ' MPH ',(F4.1,1X),7X,'F5.1,1X,F5.1,1X,F5.1)
      C
      7035 FORMAT(' CAL. YEAR: 19',I2,5X,'TEMP: ',F4.1,
      * '(F)',8X,5(F5.3,1X),F5.7,
      * /1X,' REGION: ',2A4,4X,F4.1,1X,F4.1,1X,F4.1,1X,F4.1,
      * ' MPH ',(F4.1,1X),3X,'F5.1,1X,F5.1,1X,F5.1)
      704  FORMAT(' AC: ',F6.2,2X,'XLOAD: ',3F7.2,2X,'TRAILR: ',
      * F7.2,2X,'ABSHUP: ',F7.2)
      C
      705  FORMAT(' HGWGT: ',F7.0,2X,'HDWGT: ',F7.0,2X,'HGCID: ',
      * F7.2,2X,'HDCID: ',F7.2)
      C
      7051 FORMAT(' LDV I/M PROGRAM STARTING IN 19',I2,
      * ', STRINGENCY LEVEL ',I2,2X,'MECH. TRAINING: ',A4)
      C
      7052 FORMAT(' I/M PROG. BENEFITS APPLY ONLY TO MODEL YEARS 19',

```



```

SUBROUTINE EFCALX(CY,L,KDIA,MS,EFRETM,WTEDEF,CCRETM,IDLRIM,IDLWTD,EFC00010
& INJFLG)
COMMON/FLGCOM/ALTFLG,ALHFLG,TRKFLG,IRDFLG,SP3FLG,NMHFLG,IDLFLG,
UNFFLG,MYPMPFG,INFLG,ICEVFG,PRTFLG,IFORM
COMMON/CEVCOM/CCEV
COMMON/REGCOM/IREJN
COMMON/BFCCOM/BEF
COMMON/IDLCOM/IDLBEF
COMMON/MYMCOM/MYM,MYP,Tf
INTEGER MYP,P,CYP
INTEGER ALHFLG,TRKFLG,ALTFLG,ALKOD(4,20),CY,MSFLG,SP3FLG,
NMHFLG,IDLFLG,UNFFLG,MYPRFG,PRTFLG
REAL IDLREF(20,26,3,6),IDLFAC(20,3,6),IDLCMP(3,6),IDLWTD(3)
REAL IDLRIM(3,6)
REAL COMPC(20,6),CCRETM(6)
REAL CFRET(20,3,6)
REAL BEF(20,26,3,6), CCEV(45,6),
CEFLDV(3), CEFLT1(3),
CEFLT2(3), CEFHDE(3),
CEFHD(3), CEFMCC(3),
CFRET(3,6), CMPEF(20,3,6),
COMPMY(3,6), LNKDTA(7),
MYR(20,6), PCCO,
PCCC, PCHS,
SPD(3), TEMP,
TF(20,6), TFNORM(6),
WTEDEF(3)
DIMENSION R1(20,3,6),R2(20,3,6),XISPD(3)

```

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```

PCCC = LNKDIA(5)
PCHS = LNKDIA(6)
PCCC = LNKDIA(7)

CALL BIGCFX(CY,TEMP,PCCO,PCHS,PCCC,SFD,CFRET,INIFLG)

XISPD(1)=5.0
XISPD(2)=5.0
XISPD(3)=5.0
XITEMP=75.0
XIFCCO=0.0
XIPCHS=0.0
XIFCCC=0.0
INIFLG=0
CALL BIGCFX(CY,TEMP,PCCO,PCHS,PCCC,XISPD,R1,INIFLG)
CALL BIGCFX(CY,XITEMP,XIFCCO,XIPCHS,XIPCCC,XISPD,R2,INIFLG)

CYP = CY - 69

DO 500 P = 1,3
  WTEDEF(P) = 0.0
  IDLWTD(P) = 0.0
  DO 400 M = 1,2
    CONFMY(P,M) = 0.0
    IDLCMP(P,M) = 0.0
  IF(P.EQ.1) CCFET(M)=0.
  DO 300 I = 1,20
    MYF = CY - (20-I) - 50
    IF (P.EQ.1) GO TO 323
    GO TO 444
  323 CONFET(I,P,M)=(DEF(I,CYP,P,M))*CFRET(I,P,M)+ CCFV(MYP,M))*TF(I,M)
  COMPC(I,M) =CCFV(MYP,M)*TF(I,P)
  GO TO 555
  444 COMPE(I,P,M)=(DEF(I,CYP,P,M))*CFRET(I,P,M)
  )*TF(I,M)
  EFC00410
  EFC00420
  EFC00430
  EFC00440
  EFC00450
  EFC00460
  EFC00470
  EFC00480
  EFC00490
  EFC00500
  EFC00510
  EFC00520
  EFC00530
  EFC00540
  EFC00550
  EFC00560
  EFC00570
  EFC00580
  EFC00590
  EFC00600
  EFC00610
  EFC00620
  EFC00630
  EFC00640
  EFC00650
  EFC00660
  EFC00670
  EFC00680
  EFC00690
  EFC00700
  EFC00710
  EFC00720
  EFC00730
  EFC00740
  EFC00750
  EFC00760
  EFC00770
  EFC00780
  EFC00790
  EFC00800

```

```

330 C
340 C
350 C
360 C
370 C
380 C
390 C
400 C
410 C
420 C
430 C
440 C
450 C
460 C
470 C
480 C
490 C
500 C
510 C
520 C
530 C
540 C
550 C
560 C
570 C
580 C
590 C
600 C
610 C
620 C
630 C
640 C
650 C
660 C
670 C
680 C
690 C
700 C
710 C
720 C
730 C
740 C
750 C
760 C
770 C
780 C
790 C
800 C
810 C
820 C
830 C
840 C
850 C
860 C
870 C
880 C
890 C
900 C
910 C
920 C
930 C
940 C
950 C
960 C
970 C
980 C
990 C
1000 C
1010 C
1020 C
1030 C
1040 C
1050 C

```

EFC00810
 EFC00820
 EFC00830
 EFC00840
 EFC00850
 EFC00860
 EFC00870
 EFC00880
 EFC00890
 EFC00900
 EFC00910
 EFC00920
 EFC00930
 EFC00940
 EFC00950
 EFC00960
 EFC00970
 EFC00980
 EFC00990
 EFC01000
 EFC01010
 EFC01020
 EFC01030
 EFC01040
 EFC01050

```

C
SUBROUTINE FIGCFY(CY,T,PCCC,PCHS,PCCC,SFD,CFRET,INITFL)
COMMON/FLGCOM/ALTFLG,ALHFLG,TRKFLG,IRDFLG,SP3FLG,NMHFLG,IDLFLG,
* UNFFLG,MYMRFG,IMFLG,ICEVFG,PRIFLG,IFORM
COMMON/ALTCOM/NMYALT,ALTOD
COMMON/REGCOM/IREJN
COMMON/JUNK1/AC,XLOAD,TRAILR,ARSHUM
COMMON/JUNK2/HGWGT,HDWGT,HGCID,HDCID
COMMON/REF11/ALHRET(20,4,7)
COMMON/RET2/TRKRET(20,7,2)
COMMON/SP1COM/SP1,SPAV
COMMON/MYNCOM/MYM,MYP,TF
C
INTEGER ALHFLG,TRKFLG,ALTFLG,ALTOD(4,20),CY,MSFLG,SP3FLG,
* NMHFLG,IDLFLG,UNFFLG,MYMRFG,PRIFLG
INTEGER INITFL,IEGNAR(45,3,4),HDINDX(45,3)
INTEGER CY,G(45,3,4)
C IN G, 1ST INDEX IS MY, 2ND IS REGION, AND 3RD IS MODE
C IN IEGNAR, 2ND INDEX IS POLLUTANT, 3RD IS REGION, 4TH IS MODE
C IN HDINDX, 2ND INDEX IS REGION (NOT FUNCTION OF POL, OR MODE)
C
REAL COMCCC(6),A(20,3,3),U(20,3,3),
* L(3,3),H(3)
REAL XLOAD(3)
REAL COMPEF(20,3,6)
REAL W,T,SPD(3),SPF(3),CFRET(20,3,6)
REAL D1(4,3),D2(4,3)
REAL MIDDLE,LEFT
REAL SFBACK(16,3,3),SPROT(12,3,3)
REAL ATR(4,3,2),PTR(4,3,2),CTR(4,3,2)
REAL C(4,8,3)
REAL CUMMIL(20,6),MYN(20,6),MYF(20,6),TF(20,6)
INTEGER MAXAGE(4)
C
DATA MAXAGE/19,19,19,19/
C
C*****
C**COEFFICIENTS IN SPEED/TEMP/COLD START FACTOR: EQN,INDEX,POL.
DATA C/

```



```

*      17*1,7*2,2*3,1*4,      15*1,9*2,      21*4,      B1600810
*      15*1,9*2,      21*4,      15*1,9*2,      21*4,      B1600820
*      17*1,7*2,5*3,1*4,      17*1,7*2,5*3,1*4,      21*4,      B1600830
*      17*1,7*2,2*3,1*4,      17*1,7*2,2*3,1*4,      21*4,      B1600840
*      17*1,7*2,21*3,      17*1,7*2,21*3,      21*4,      B1600850
*      17*1,7*2,21*3,      17*1,7*2,      21*4,      B1600860
*      17*1,7*2,      21*4,      17*1,7*2,      21*4,      B1600870
*      17*1,7*2,21*3,      17*1,7*2,21*3,      21*4,      B1600880
*      17*1,7*2,21*3,      28*2,17*3,      B1600890
*      28*2,17*3,      27*2,1*4,      B1600900
*      27*2,1*4,      27*2,1*4,      B1600910
*      28*2,17*3,      28*2,17*3,      B1600920
*      28*2,17*3,      27*1,18*2,27*1,18*2,27*1,1*4,      B1600930
*      27*1,18*2,27*1,18*2,27*1,1*4,      B1600940
*      27*1,1*4,27*1,18*2,27*1,1*4,      B1600950
*      27*1,1*4,27*1,18*2,27*1,18*2,      B1600960
*      DATA HDINDEX/19*1,4*2,5*3,17*4,      B1600970
*      19*1,4*2,1*3,21*4,      B1600980
*      19*1,4*2,5*3,17*4,      B1600990
*      IF(INITFL.NE.1) GO TO 177      B1601000
*      HERE 1ST TIME      B1601010
*      INITFL = 0      B1601020
*      SFB(1) = 26.0      B1601030
*      SFB(2) = 16.0      B1601040
*      SFB(3) = 26.0      B1601050
*      CALL SFBCLX(SFB,SFROUT)      B1601060
*      CALL GFTCUM((CUMMIL)      B1601070
*      C      B1601080
*      C      B1601090
*      C      B1601100
*      C      B1601110
*      C      B1601120
*      C      B1601130
*      C      B1601140
*      C      B1601150
*      C      B1601160
*      C      B1601170
*      C      B1601180
*      C      B1601190
*      C      B1601200

```



```
      C      IGX = G(MYC,IFEJN,IMODE)
      C      DO 500 IP = 1,3
      C      C*DEFAULT
      C      IEQN = IEQNAR(MYC,IP,IFEJN,IMODE)
      C      C*****
      C      IF(ALTFLG.EQ.0) GO TO 777
      C
      C      DO 450 ICH = 1,NMYALT
      C      IF(ALTMOD(1,ICH).EQ.MY) GO TO 877
      C      CONTINUE
      C      GO TO 550
      C      CONTINUE
      C      C*HERE FOR ALTERATION
      C      IALT = ALTMOD(IP+1,ICH)
      C
      C      IF(IALT.EQ.0) GO TO 777
      C      IF(IALT.EQ.1) IEQN = 3
      C      IF(IALT.GT.1) IEQN = 4
      C      CONTINUE
      C      C*****
      C      550 CONTINUE
      C
      C      FACL = FCO
      C      FACM = FHO
      C      IF(IEQN.LT.2) GO TO 888
      C      FACL = FCC
      C      FACM = FHC
      C      FACR = (1.0 - FACL - FACM)
      C      888
      C      C*****
      C      DENOM = D1(IEQN,IP) + D2(IEQN,IP)*VMTAGE
      C
      C      B1601610
      C      B1601620
      C      B1601630
      C      B1601640
      C      B1601650
      C      B1601660
      C      B1601670
      C      B1601680
      C      B1601690
      C      B1601700
      C      B1601710
      C      B1601720
      C      B1601730
      C      B1601740
      C      B1601750
      C      B1601760
      C      B1601770
      C      B1601780
      C      B1601790
      C      B1601800
      C      B1601810
      C      B1601820
      C      B1601830
      C      B1601840
      C      B1601850
      C      B1601860
      C      B1601870
      C      B1601880
      C      B1601890
      C      B1601900
      C      B1601910
      C      B1601920
      C      B1601930
      C      B1601940
      C      B1601950
      C      B1601960
      C      B1601970
      C      B1601980
      C      B1601990
      C      B1602000
```

```

LEFT = FACL * (EXP(C(IFGN,1,IP))+T*(IEQN,2,IP)) + (IEQN,3,IP) +
* C(IEQN,4,IP)*VMTAGE) * SPEACK(2,1,IP)/SPROT(2,1,IP)
C
C
MIDDLE=FACM*(C(IEQN,5,IP)+(C(IEQN,6,IP)*VMTAGE)
* SPEACK(IGX,7,IP)/SPROT(IGX,3,IP)
C
C
RIGHT=FACR*(C(IEQN,7,IP)+(C(IEQN,8,IP)*VMTAGE)
* SPEACK(IGX,2,IP)/SPROT(IGX,2,IP)
C
TCF = LEFT + MIDDLE + RIGHT
C
C
FACTOR = TOF/DENOM
C
IF(ALHFLG.EQ.1) FACTOR = FACTOP*ALHRET(I,IMODE,IP)
C
IMOD2 = IMODE
C
IF(IMODE.EQ.4) IMOD2 = 6
C
CFRET(I,IP,IMOD2) = FACTOR
C
500 CONTINUE
C
C*****
C
FOR MODES 4 AND 5
C
DATA ATR/ 2.42, 1.14, 1.56, 1.54,
* 1.74, 1.54, 1.24, 0.62,
* .51, .812, .870, .764,
* 0.94, 0.64, .820, 1.20,
* 1.44, 1.64, 1.20, 1.44,
* 0.62, 0.62, 0.72, 1.00 /
C
DATA ETR/ -.153, -.065, -.096, -.071,
C

```

```

*      -.117.  -.007.  -.070.  -.030.
*      .0074.  .0004.  .0041.  .0120.
*      -.055.  -.055.  -.051.  -.072.
*      -.092.  -.002.  -.072.  -.088.
*      -.043.  -.043.  -.054.  -.074. /

      DATA CTR/ .0016. .0004. .0009. -.0003.
*      .0015. .0010. .0008. .0004.
*      .0000. .0000. .0000. .0000.
*      .0004. .0004. .0005. .0006.
*      .0010. .0010. .0006. .0002.
*      .0006. .0006. .0009. .0012. /

      IF (TRKFLG.EQ.1) CALL TRKOPC(CY,HCHGT,HMWGT,HGCID,HDCID)
C
C      IF (SP3FLG.EQ.0) SPAV = SPD(1)/(1.3777396 - (PCCC+.70/79.42))
C      IF (SP3FLG.EQ.0) SPAV = SPD(1)
C      IF (SP3FLG.EQ.1) SPAV = SPD(1)/(1.41114406 - (PCCC+.0041114406))
C      IF (SP3FLG.EQ.1) SPAV = SPD(2)
C      IF (SP3FLG.EQ.1) SPAV = AMIN1(SPD(1),SPD(2))
C**ELIMINATE TWO LINES ABOVE
C
      DO 700 IMODE = 4.5
      IF = IMODE-7
      DO 700 IF = 1.3

      IMY1 = CY-19
      DO 700 IMY = IMY1,CY
      IMYP = IMY - 50
      IF (IMYP.LT.1) IMYP=1

      IA = 20-(CY-IMY)

      INDX = MINDEX(IMYP,IFEJN)

      IF (IP.EQ.3.AND.IMODE.EQ.4) GO TO 720

      CFPET(JX,IP,IMODE) = EXP(ATR(INDX,IP,IM) +
*      PIR(INDX,IP,IM)*SPAV + CTR(INDX,IP,IM)*SPAV*SPAV)

```

```
C
720      GO TO 680
C      CONTINUE
C
C      CFRET(IX,IP,IMODE) = ATR(INLX,IP,IM) + ETR(INDX,IP,IM)*SFAV
C      CONTINUE
C
C      IF((TRKFLG.EC.1) CFRET(IX,IP,IMODE) = CFRET(IX,IP,IMODE)*
+      TRKRET(IX,IP,IM)
C
C      CONTINUE
C      RETURN
C
C      DEBUG SURCHK
C      END
```

BI602810
BI602820
BI602830
BI602840
BI602850
BI602860
BI602870
BI602880
BI602890
BI602900
BI602910
BI602920
BI602930
BI602940
BI602950
BI602960

SUBROUTINE INITEX(NMYALT , ALTKOD)

C COMMON/FLGCOV/ALTFLG,ALHFLG,TRKFLG,IPDFLG,SP3FLG,NMHFLG,IDLFLG,

R UNFFLG,NMYFFG,ICEVFG,PRTFLG,IFCFM

INTEGER ALHFLG,TRKFLG,ALTFLG,ALTYOD(4,20),CY,MSFLG,SP3FLG,

* NMHFLG,IDLFLG,UNFFLG,NMYRFG

C CALL BEFGEN

C CALL CCEVAX

C IF (ALTFLG.(0.1) CALL EFALT(NMYALT,ALTKOD)

C RETURN

C END

INX00010
INX00020
INX00030
INX00040
INX00050
INX00060
INX00070
INX00080
INX00090
INX00100
INX00110
INX00120
INX00130
INX00140
INX00150
INX00160
INX00170

```

SUBROUTINE TFCALY
C
C COMPON/MYMCCM/MYM,FVF,TF
REAL TFNORM(6),MYM(20,6),MYR(20,6),TF(20,6)
C
DO 850 M = 1,6
    TFNORM(M) = 0.0
    DO 810 I = 1,20
        TFNORM(M) = TFNORM(M) + MYM(I,M)*MYR(I,M)
    DO 820 J = 1,20
        TF(21-I,M) = ( MYM(I,M)*MYR(J,M) )/TFNORM(M)
    CONTINUE
    RETURN
    DEBUG SUBCHP
C
C
C
C
END

```

TFC00010
TFC00020
TFC00030
TFC00040
TFC00050
TFC00060
TFC00070
TFC00080
TFC00090
TFC00100
TFC00110
TFC00120
TFC00130
TFC00140
TFC00150
TFC00160
TFC00170
TFC00180
TFC00190

```

C
SUBROUTINE SPFCLY(SPARG,SPACK)
COMMON/ACOM/A
REAL SPARG(3),SPACK(18,7,3),A(6,18,3)

DO 30 IP = 1,3
  DO 20 IG = 1,12
    IGG = IG
    DO 10 IS = 1,3
      SUM = A(IG,IGG,IP)
      S = SPARG(IS)
      DO 5 I = 1,5
        SUM = SUM*S + A(6-I,IGG,IF)
      CONTINUE
      SCF=EXP(SUM)
      IF(IP.EQ.3) SCF=SUM
      SPACK(IG,IS,IP) = SCF
    CONTINUE
  CONTINUE
CONTINUE
RETURN
DEBUT SURCHY
END

```

```

SPF00010
SPF00020
SPF00030
SPF00040
SPF00050
SPF00060
SPF00070
SPF00080
SPF00090
SPF00100
SPF00110
SPF00120
SPF00130
SPF00140
SPF00150
SPF00160
SPF00170
SPF00180
SPF00190
SPF00200
SPF00210
SPF00220

```

```

C
SUBROUTINE IEFGEN
COMMON/FLGCOM/ALTFLG,ALHFLG,TRKFLG,IRDFLG,SP3FLG,NMHFLG,IDLFLG,
* UNFFLG,MYMPFG,JAFLG,ICEVFG,PFTFLG,IFORM
COMMON/REGCOM/IREJN
COMMON/BEFCOM/BEF
COMMON/BASECM/BASEZR
COMMON/DELCOM/DELR
COMMON/IDLBOM/IDLBZR
COMMON/IDLDCM/IDLZR
COMMON/IDLCOM/IDLRFF
COMMON/INDXCM/INDXR
COMMON/MYMCOM/MYM,MYR,TF
C
REAL HASE3R(10,3,6,3),DELR(10,3,6,3)
REAL IDLB3R(10,3,6,3),IDEL3R(10,3,6,3)
REAL NONMTH(45,6)
REAL BEF(20,26,3,6),IDLEEF(20,26,3,6)
REAL CUMMIL(20,6),MYM(20,6),MYR(20,6),TF(20,6)
C
INTEGER ALHFLG,TPKFLG,ALTFLG,MSFLG,SP3FLG,
* NMHFLG,IDLFLG,UNFFLG,NYMRFG,PRTFLG
INTEGER INDEXR(30,3,6,3)
INTEGER MAXAGE(6)
C
DATA MAXAGE/19,10,19,19,19,19/
DATA NONMTH/
* 24*.95 , 21*.95 ,
* 24*.95 , 21*.95 ,
* 24*.95 , 4*.95 , 17*.85 ,
* 24*.95 , 8*.95 , 13*.95 ,
* 45*.95 ,
* 45*.95 /
C
*****
CALL GETCUM(CUMMIL)
*****
C
*****
REF00010
REF00020
REF00030
REF00040
REF00050
REF00060
REF00070
REF00080
REF00090
REF00100
REF00110
REF00120
REF00130
REF00140
REF00150
REF00160
REF00170
REF00180
REF00190
REF00200
REF00210
REF00220
REF00230
REF00240
REF00250
REF00260
REF00270
REF00280
REF00290
REF00300
REF00310
REF00320
REF00330
REF00340
REF00350
REF00360
REF00370
REF00380
REF00390
REF00400

```

```

C      PC 100 IMODE=1,6
          FAX = MAXAGE(IMODE)
C
      DO 100 ICY = 70,95
      DO 100 IF = 1,2
        IMY1=ICY-19
        IMY12=ICY
        ICYP=ICY-25
C
      DO 100 MY = IMY1,IMY13
        IMYP = MY - 50
        IAGE=ICY - MY
C
        IF(IAGE.GT.MAX) IAGE = MAX
C
        AGE = IAGE
        IA2=ICY-MY+1
        IA3=21-IA2
C
        IF(MY.LT.66) INDX=1
        IF(MY.GE.66) INDY=INDEX(MY-65,IP,IMODE,IREFJN)
        VHTAGE = CUMMIL(IAGE+1,IMODE)*.0001
C
        DEF(IA7,ICYP,IP,IMODE) =
          *   PASETR(INDX,IP,IMODE,IPEJN) +
          *   VHTAGE*DLLBF(INDX,IP,IMODE,IREFJN)
C
        IDLDEF(IA3,ICYP,IP,IMODE) =
          *   IDLBTR(INDX,IP,IMODE,IREFJN) +
          *   VHTAGE*IDLBTR(INDX,IP,IMODE,IREFJN)
C
      CONTINUE
      DO 450 I=1,20
      DO 450 J=1,26
      DO 450 IM=1,6
        IF(NMHFLG.EQ.1)DEF(I,J,1,IP)=DEF(I,J,1,IM)*NONMTF(I+J-1,IM)
      CONTINUE
    450

```

APPENDIX A.

ISFAP MODEL

COMPUTER PROGRAM SOURCE CODE,

ENVIRONMENTAL PROTECTION AGENCY

```

C
C
C*****
C
C  WRITE(6,444) CUMMIL
444  FORMAT(1X,10F8.0)
C
C  DEBUG SUPCHK
C
C  RETURN
C  END
REF00810
REF00820
REF00830
REF00840
REF00850
REF00860
REF00870
REF00880
REF00890
REF00900
REF00910

```


APPENDIX A. ISMAP MODEL

C	WRITE(6,444) (UNMIL	GET00410
444	FORMAT(1Y,10F3.0)	GET00420
C		GET00430
	RETURN	GET00440
C	DEBUG SUBCHV	GET00450
C	END	GET00460
		GET00470

COMPUTER PROGRAM SOURCE CODE

13744 MOD-L

SUBROUTINE EFALTX(NYALT, ALTVOD)

COMMON/EFFCOR/REF

INTEGER ALTVOD(4,20),NMYALT,CYI,P,ISTD1(3),MYI,ICY

REAL REF(20,26,3,6),EFREF(20,4,3)

```

DATA EFREF/1.0,1.2,1.4,1.6,1.8,2.0,2.2,2.4,2.6,2.8,3.0,3.0,3.0,
* 0.6,0.7,0.8,1.0,1.1,1.2,1.3,1.4,1.6,1.7,3*1.8,
* 0.27,0.32,0.38,0.43,0.49,0.54,0.59,0.65,0.70,0.76,3*0.81,1*0.8,
* 0.27,0.32,0.38,0.43,0.49,0.54,0.59,0.65,0.70,0.76,3*0.81,1*0.8,
* 23.7,26.8,30.0,33.1,36.2,39.4,42.5,45.7,48.8,4*51.9,
* 23.7,26.8,30.0,33.1,36.2,39.4,42.5,45.7,48.8,4*51.9,
* 6.58,10.12,13.26,16.40,19.54,22.68,25.82,28.96,32.10,4*35.24,
* 6.58,10.12,13.26,16.40,19.54,22.68,25.82,28.96,32.10,4*35.24,
* 2.2,4.16,6.12,8.08,10.04,12.00,13.96,15.92,17.88,4*19.84,
* 2.2,4.16,6.12,8.08,10.04,12.00,13.96,15.92,17.88,4*19.84,
* 13*0.0,
* 2.00,2.06,2.12,2.18,2.24,2.30,2.36,2.42,2.48,2.54,3*2.60,
* 1.50,1.56,1.62,1.68,1.74,1.80,1.86,1.92,1.98,2.04,3*2.10,
* 1.00,1.04,1.08,1.12,1.16,1.20,1.24,1.28,1.32,1.36,3*1.40,
* 1.00,1.04,1.08,1.12,1.16,1.20,1.24,1.28,1.32,1.36,3*1.40,
* 0.24,0.29,0.34,0.40,0.46,0.52,0.58,0.64,0.70,0.76,3*0.81,1*0.8,

```

PG 200 I = 1,NMYALT

```

MYI1 = ALTVOD(1,1) - 69
ISTD1(1) = ALTVOD(2,1)
ISTD1(2) = ALTVOD(3,1)
ISTD1(3) = ALTVOD(4,1)

```

```

DO 110 P = 1,7
  ICODE1 = ISTD1(P)
  IF(ICODE1.EQ.0) GO TO 110
  DO 100 K = 1,20
    IRLV = 21-K
    IN1 = K-1
    ICY = MYI1 + IN1
    IF(ICY.GT.26) GO TO 100
    REF(IRLV,ICY,P,1) = EFREF(K,ICODE1,P)
  CONTINUE

```

100

CONTINUE

110

C

EFA00010
EFA00020
EFA00030
EFA00040
EFA00050
EFA00060
EFA00070
EFA00080
EFA00090
EFA00100
EFA00110
EFA00120
EFA00130
EFA00140
EFA00150
EFA00160
EFA00170
EFA00180
EFA00190
EFA00200
EFA00210
EFA00220
EFA00230
EFA00240
EFA00250
EFA00260
EFA00270
EFA00280
EFA00290
EFA00300
EFA00310
EFA00320
EFA00330
EFA00340
EFA00350
EFA00360
EFA00370
EFA00380
EFA00390
EFA00400

END	CONTINUE	EFA00410
C		EFA00420
	RETURN	EFA00430
C		EFA00440
C	DEPUC SUPCHA	EFA00450
C		EFA00460
	END	EFA00470

APPENDIX A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE.

ENVIRONMENTAL PROTECTION AGENCY

RTURN
DEBUG SUBCH
END

CCE00410
CCE00420
CCE00430


```

C
SUBROUTINE LDVIMY
COMMON/BFCOM/BFC(20,26,*,6)
COMMON/IMCOM/ICYM,ISTRN,IMTFLG,MODYP1,MODYR2
COMMON/IMCRED/PCIM
C
C      INTEGER CY,CYP,CYIMP,CYIP1,DELY,DEL2,DFL
C      INTEGER PCIM(19,5,4,2,2)
C      IN PCIM: DEL,ISTRN,I TECH,I PROGRAM,I POL
C*****
C      IPROGRAM = 1 + IMTFLG
C      ISTRN = .1*ISTRN
C      IF(ISTRN.LT.1D.OR.ISTRN.GT.5D) STOP
C      IKEM = ISTRN - (ISTRN/1D)*1D
C      REM=IREM*.1
C      ISTRN = ISTRN*.1
C      STRN = (ISTRN + 0.5)*0.1
C      ISTRN = STRN
C      CYIMP = ICYM
C      CYIP1 = ICYM + 1
C
C      DO 100 IPOL=1,2
C      DO 100 CY = CYIP1,25
C          CYP = CY-59
C          DELY = CY - CYIMP
C
C          DO 90 I = 1,20
C              MY = CY - (20-I)
C              MYP = MY - 50
C              DEL2 = MY - CYIMP
C
C              IF(MY.LT.MODYR1.OR.MY.GT.MODYR2) GO TO 90
C
C              IF(MY.LE.CYIMP) DEL = DELY
C              IF(MY.GT.CYIMP) DEL = DELY - DEL2
C              IF(DELT.GT.1C) DEL = 19

```



```

C
SUBROUTINE ALUH(CY,AC,YLOAD,TRAILR,PCCC,PCCC,ABSHUM)
C
COMMON/RET1/ALHRET(20,4,3)
C
INTEGER CY
REAL COMPEF(20,3,6)
REAL XLOAD(3)
REAL PCW(20),CFNIX(20,3,6),COMCCCC(6),CFLET(20,3,6),TF(20,6)
REAL A(20,3,3),U(20,3,3),L(3,3),H(3)
REAL TCFA(3),TCFB(3),TCFC(3)
REAL CFLD(3)
REAL ACCF(3),PCWAC(45)
C
DATA ACCF/1,13,1,12,1,12/
DATA CFLD/1,06,1,20,1,03/
DATA PCWAC/15*,54,3*,06,4*,75,2*,81,21*,81/
C IN TCFA ABOVE, 2ND VALUE SHOULD BE 2.15..IT IS 1.15 FOR ORE. CF.
C
PCCOLD=PCCC*.01
C
DO 207 IP=1,3
H(IP)=1.
DO 207 IM=1,3
L(IP,IM)=1.
DO 207 IT=1,20
A(IT,IP,IM)=1.
U(IT,IP,IM)=1.
ALHRET(IT,4,IP) = 1.
207 CONTINUE
C
DO 500 IP = 1,3
DO 400 IMODE=1,3
C
IF(IMODE.EQ.3) GO TO 15
C*****A: AIR CONDITIONING CORRECTION FACTOR
DO 90 J=1,20
INY = CY - (20-I) - 50
PCW(I)=PCWAC(IMY)

```

```

20      A(J,IMODE,IP) = AC*PC*AC(IMY)*(ACCF(IP)-1.) + 1.0
C      CONTINUE

C*****U: TRAILER TOWING CORRECTION FACTOR
DO 91 I=1,20
  IMY=CY-(20-I)-50
  IF(IMY.GT.24) GO TO 77
  CFA=TCFA(IP)
  GO TO 78
CONTINUE
CFA=(PCCOLD*TCFA(IP) + (1.-PCCOLD)*TCFA(IP))/
  * (PCCOLD + (1.-PCCOLD)*TCFC(IP))
78      CONTINUE
C      U(I,IMODE,IP) = TRAILR*(CFA-1.) + 1.0
C      CONTINUE
91      CONTINUE
C      CONTINUE
15      CONTINUE
C*****L: ADDITIONAL LOADING CORRECTION FACTOR
L(IMODE,IP) = XLOAD(IMODE)*(CFLD(IP)-1.) + 1.
C
400     CONTINUE
500     CONTINUE
C*****H: HUMIDITY CORRECTION FACTOR
DO 675 IMODE=1,3
  H(IMODE) = 1. - .0047*(APSHUM - 75.)
675     CONTINUE
C
C
DO 800 IP=1,3
DO 500 IMODE=1,3
DO 600 IY=1,20
  ALHTMP = A(IY,IMODE,IP)*U(IY,IMODE,IP)*L(IMODE,IP)
  IF(IP.EQ.3) ALHTMP = ALHTMP*H(IMODE)
  ALHRET(IY,IMODE,IP) = ALHTMP
CONTINUE
800     C

```

ALU0041U
 ALU00420
 ALU00430
 ALU00440
 ALU00450
 ALU00460
 ALU00470
 ALU00480
 ALU00490
 ALU00500
 ALU00510
 ALU00520
 ALU00530
 ALU00540
 ALU00550
 ALU00560
 ALU00570
 ALU00580
 ALU00590
 ALU00600
 ALU00610
 ALU00620
 ALU00630
 ALU00640
 ALU00650
 ALU00660
 ALU00670
 ALU00680
 ALU00690
 ALU00700
 ALU00710
 ALU00720
 ALU00730
 ALU00740
 ALU00750
 ALU00760
 ALU00770
 ALU00780
 ALU00790
 ALU00800

A A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE

ENVIRONMENTAL PROTECTION AG

RETURN
DEBUG SUPCHK
END

C

ALU000810
ALU000820
ALU000830

```

C
SUBROUTINE TRKOPC(CY,HGWGT,HDWGT,HGCID,HDCID)
COMMON/RET2/TRKRFT(20,3,2)
INTEGER CY,INDXAR(45)
C**IN E0,E1,AND B2, 1ST INDEX IS YEAR GROUP, 2ND IS VEHTYPE,3RD IS POL
REAL B0(3,2,3),B1(3,2,3),B2(3,2,3)
C
DATA B0/1.302,-.584,.762,2.058,2.058,.893,
*      .814,.354,.320,-.533,-.533,-.299,
*      .869,.887,.943,.085,.085,.138
C
DATA B1/1.177,.124,.131,-.005,-.005,.015,
*      -.036,.106,.149,-.03,-.03,.03,
*      .172,.016,.008,.02,.02,.027
C
DATA B2/-.065,-.01,-.047,-.014,-.014,-.006,
*      .016,-.024,-.045,.043,.043,.003,
*      -.054,-.007,-.012,.002,.002,.001
C
DATA INDXAR/19*1.4*2.22*3/
DO 100 IPOL=1,20
MY = CY - (20-IPOL) - 50
IX=INDXAR(MY)
DO 100 IPOL = 1,3
TRKRFT(IMY,IPOL,1) = B0(IX,1,IPOL) + B1(IX,1,IPOL)*HGWGT*.001 +
*      B2(IX,1,IPOL)*HGWGT/HGCID
C
TRKRFT(IMY,IPOL,2) = B0(IX,2,IPOL) + B1(IX,2,IPOL)*HDWGT*.001 +
*      B2(IX,2,IPOL)*HDWGT/HDCID
C
100 CONTINUE
C
RETURN
DEBUG SUBCHK
END
TRK00010
TRK00020
TRK00030
TRK00040
TRK00050
TRK00060
TRK00070
TRK00080
TRK00090
TRK00100
TRK00110
TRK00120
TRK00130
TRK00140
TRK00150
TRK00160
TRK00170
TRK00180
TRK00190
TRK00200
TRK00210
TRK00220
TRK00230
TRK00240
TRK00250
TRK00260
TRK00270
TRK00280
TRK00290
TRK00300
TRK00310
TRK00320
TRK00330
TRK00340
TRK00350
TRK00360
TRK00370
TRK00380
TRK00390

```


4X A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE.

ENVIRONMENTAL PROTECTION AGE

PLOCK DATA

```
COMMON /LINK/ NLINK,NLANF(200),X1(200),Y1(200),X2(200),
1Y2(200),LCAF(200),DIST(200),VEL(200),LCON(200,3),
2NSTOPS(200)
INTEGER NSTOPS/200*0/
COMMON /INTRST/ NINS,LIN(70,4),ITYPC(70),ICYCL(70),
1PH(70,4),CI(70),GCAP(70,4),QUE(70,4)
REAL QUE/280*0.0/
COMMON /PARKZ/ PZ,PV(50),PLA(50),VZ(50),ZV(50),PD,PLS,
1PLBO,PNOS(50),PLL(50)
REAL PV/50*0.0/,PLA/50*0.0/,PLS/15.0/,PLBO/12.0/
COMMON /VENTYP/ VT,VTP(3),VTE(3),VTMULT(2),S7VTP(3,2)
REAL VTP/1.4,14.0,1.0/
END
```

```
BL100010
BL100020
BL100030
BL100040
BL100050
BL100060
BL100070
BL100080
BL100090
BL100100
BL100110
BL100120
BL100130
BL100140
```

APPENDIX A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE.

FLOCK DATA

COMMON/COEFFM/BAD1,BAD2,FAD3,EAD4

COMMON/DET/DETER

REAL DETER(20),BAD1(12,5),BAD2(12,5),BAD3(12,5),BAD4(12,5)

DATA BAD1/

8 0.10210419E+01,-0.46106476E-01, 0.12750413E-01, 0.19804664E-01,

8 0.10487151E-02,-0.15174127E+00, 0.19398060E-01,-0.79918522E-04,

8 -0.27256622E-03, 0.33066291E+00,-0.24132896E-02, 0.32060244E-03,

8 0.63576120E+00,-0.24510358E-01, 0.43812852E-01, 0.49628541E-02,

8 0.44958130E-03,-0.47977134E-01, 0.61538182E-02, 0.10994070E-04,

8 -0.67511966E-04, 0.30338836E+00,-0.27355787E-02, 0.13473761E-03,

8 0.28043031E+00,-0.4758350E-02, 0.43524541E-01, 0.13808063E-02,

8 0.10754808E-03,-0.21531650E-02, 0.93090301E-03, 0.11250070E-04,

8 -0.19257031E-05, 0.22921783E+00,-0.40214434E-02, 0.12248126E-03,

8 0.49613750E+00,-0.14627926E-01, 0.61504323E-01,-0.10729437E-02,

8 0.21254545E-03,-0.68027652E-02, 0.97647379E-03, 0.10525828E-03,

8 0.37405029E-04, 0.26291054E+00,-0.18189936E-02, 0.84008745E-04,

8 0.50066710E+00,-0.1758655E-01, 0.59339337E-01,-0.18133272E-02,

8 0.22920808E-03,-0.12368988E-01, 0.11492474E-02, 0.74215845E-04,

8 0.14108437E-04, 0.30531263E+00,-0.70244968E-02, 0.10785337E-03/

8 DATA BAD2/

8 0.39664203E+00,-0.13212890E-01, 0.58552373E-01,-0.19716325E-02,

8 0.16135792E-03,-0.43251887E-02, 0.21358313E-03, 0.86380664E-04,

8 0.40023762E-04, 0.24617422E+00,-0.68550445E-02, 0.10254829E-03,

8 0.36676234E+00,-0.14121491E-01, 0.68226576E-01,-0.32857144E-02,

8 0.18291990E-03, 0.22933202E-02, 0.19526284E-04, 0.13627447E-03,

8 0.54617223E-04, 0.22517568E+00,-0.46133995E-02, 0.69841262E-04,

8 0.10577946E+01,-0.67509890E-01, 0.62050894E-01, 0.11177700E-01,

8 0.14054242E-02,-0.1735453E+00, 0.21822363E-01, 0.12219173E-03,

8 -0.29136962E-03, 0.30515999E+00,-0.65915225E-02, 0.36294828E-03,

8 0.68093568E+00,-0.48967101E-01, 0.90703070E-01, 0.41544996E-02,

8 0.97224675E-03,-0.92597908E-01, 0.13378501E-01, 0.19100340E-03,

8 -0.13010977E-03, 0.19975567E+00,-0.77630468E-02, 0.33748685E-03,

8 0.10887880E+01,-0.71657783E-01, 0.56213565E-01, 0.12077432E-01,

8 0.14173663E-02,-0.18242314E+00, 0.22780791E-01, 0.11450195E-03,

8 -0.30368124E-03, 0.31737499E+00,-0.97049810E-02, 0.31322357E-03/

8 DATA BAD3/

8 0.12207556E+01,-0.89525878E-01, 0.95823228E-01, 0.61595142E-02,

8 0.17752303E-02,-0.19405907E+00, 0.24501167E-01, 0.30660117E-03,

8 -0.31120144E-03, 0.30530826E+00,-0.67905560E-02, 0.22574072E-03,

```

BLOCK DATA
COMMON /LINK/ NLINK,NLANK(200),X1(200),Y1(200),X2(200),
1Y2(200),LCAP(200),NIST(200),VEL(200),LCON(200,3),
2NSTOPS(200)
INTEGER NSTOPS/200*0/
COMMON /INTRST/ NINS,LIN(70,4),ITYPE(70),ICVCL(70),
1PH(70,4),CI(70),GCAP(70,4),QUE(70,4)
REAL QUE/280*0.0/
COMMON /PARK7/ PZ,PV(50),PLA(50),VZ(50),ZV(50),PD,PLS,
1PLB0,PNOS(50),PLL(50)
REAL PV/50*0.0/,PLA/50*0.0/,PLS/15.0/,PLR0/12.0/
COMMON /VEHTYP/ VT,VTP(3),VTE(3),VTMULT(2),S7VTP(3,2)
REAL VTP/1.4,14.0,1.0/
END
PL100010
BL100020
BL100030
BL100040
BL100050
BL100060
BL100070
BL100080
BL100090
BL100100
BL100110
BL100120
BL100130
BL100140

```

```

R 0.14531040E+01,-0.10345673E+00, 0.72227307E-02, 0.59160882E-02, BL200410
R 0.20053601E-02,-0.23721021E+00, 0.26225589E-01, 0.23920002E-04, BL200420
R -0.39849989E-03, 0.32376998E+00,-0.91728717E-02, 0.29819994E-03, BL200430
R 0.11040087E+01,-0.79453886E-01, 0.56303188E-01, 0.17077201E-02, BL200440
R 0.16181599E-02,-0.17064410E+00, 0.19903409E-01, 0.20100000E-03, BL200450
R 0.26853571E+00,-0.12715691E-01, 0.75969696E-02, 0.26727002E-03, BL200460
R 0.16614000E-03, 0.70702210E-02, 0.46436000E-03, 0.31504999E-02, BL200470
R 0.56589997E-04, 0.15976292E+00,-0.65233000E-02, 0.14813000E-03, BL200480
R 0.20974290E+00,-0.12848910E-01, 0.96859634E-01,-0.66359304E-02, BL200490
R 0.18598999E-03, 0.21724630E-01,-0.15685901E-02, 0.27883006E-03, BL200500
R 0.12293000E-03, 0.11327944E+00,-0.28685799E-02, 0.47189995E-04, BL200510
DATA BAD4/
R 0.57665521E+00,-0.36277410E-01, 0.21571960E-01, 0.29442401E-02, BL200520
R 0.63650007E-03,-0.52853432E-01, 0.69414489E-02,-0.17560000E-04, BL200530
R -0.94470000E-04, 0.25530094E+00,-0.76948516E-02, 0.13530999E-03, BL200540
R 0.54005557E+00,-0.39594091E-01, 0.28321180E-01, 0.14426301E-02, BL200550
R 0.70013991E-03,-0.57096951E-01, 0.73297806E-02, 0.53550000E-04, BL200560
R -0.85880005E-04, 0.20601881E+00,-0.58017895E-02, 0.85580000E-04, BL200570
R 0.21578521E+00,-0.12577798E-01, 0.51477208E-01,-0.23425999E-02, BL200580
R 0.16780000E-03,-0.15755999E-02, 0.26229994E-03, 0.12529999E-03, BL200590
R 0.46500004E-04, 0.11455778E+00,-0.46298988E-02, 0.69899994E-04, BL200600
R 0.21578521E+00,-0.12577798E-01, 0.51477208E-01,-0.23425999E-02, BL200610
R 0.16780000E-03,-0.15755999E-02, 0.26229994E-03, 0.12529999E-03, BL200620
R 0.46500004E-04, 0.11455778E+00,-0.46298988E-02, 0.69899994E-04, BL200630
R 0.21578521E+00,-0.12577798E-01, 0.51477208E-01,-0.23425999E-02, BL200640
R 0.16780000E-03,-0.15755999E-02, 0.26229994E-03, 0.12529999E-03, BL200650
R 0.46500004E-04, 0.11455778E+00,-0.46298988E-02, 0.69899994E-04, BL200660
DATA DETER/.146,.214,.558,.671,.708,.824,.1033,.312,.290,.327,
R .351,.218,.217,.407,.524,.558,.584,.379,.144,-0.037/
END

```

COMPUTER PROGRAM SOURCE CODE

APPENDIX A. ISMAP MODEL

BLOCK DATA

C COMMON/ACOM/AIN1,AIN2,AIN3

C PEAL AIN1(6,12),AIN2(6,12),AIN3(6,12)

C C*HC SPEED CORRECTION FACTOR COEFFICIENTS

DATA AIN1/
 *2.2461,-.29097,0.015889,-.47249E-03,0.69408E-05,-.39280E-07,
 *2.3103,-.28957,0.015299,-.44669E-03,0.64818E-05,-.36346E-07,
 *2.1656,-.26999,0.014420,-.43364E-03,0.65074E-05,-.77810E-07,
 *2.3973,-.29998,0.016135,-.48749E-03,0.72909E-05,-.41977E-07,
 *2.4087,-.30819,0.016817,-.50684E-03,0.75385E-05,-.43160E-07,
 *2.2322,-.28499,0.015323,-.45674E-03,0.67349E-05,-.38380E-07,
 *2.2522,-.28778,0.015682,-.47318E-03,0.70795E-05,-.40846E-07,
 *2.0278,-.27305,0.015360,-.46030E-03,0.67853E-05,-.38488E-07,
 *2.1506,-.28362,0.015380,-.44214E-03,0.62873E-05,-.34631E-07,
 *2.2302,-.29365,0.016240,-.48415E-03,0.71159E-05,-.40286E-07,
 *2.1223,-.29107,0.016910,-.52615E-03,0.80271E-05,-.47012E-07,
 *2.1536,-.28345,0.015700,-.46976E-03,0.69383E-05,-.39471E-07,
 *2.0735,-.28035,0.017300,-.55471E-03,0.86420E-05,-.51311E-07,
 *2.3495,-.30496,0.016842,-.50962E-03,0.75952E-05,-.43496E-07,
 *2.1134,-.28568,0.016320,-.50079E-03,0.75507E-05,-.43719E-07,
 *2.1194,-.29863,0.018450,-.61654E-03,0.92066E-05,-.60402E-07,
 *2.6838,-.34463,0.019542,-.62572E-03,0.97844E-05,-.58337E-07,
 *2.3954,-.33578,0.021161,-.73155E-03,0.12072E-04,-.74857E-07/

C C*CO SPEED CORRECTION FACTOR COEFFICIENTS

DATA AIN2/
 * 1.8198,-.25466,.015235,-.48740E-03,.75821E-05,-.44951E-07,
 * 2.3359,-.29698,.016007,-.47740E-03,.70675E-05,-.40398E-07,
 * 2.4415,-.29147,.014206,-.38785E-03,.52978E-05,-.28244E-07,
 * 2.4655,-.30502,.016050,-.47397E-03,.69908E-05,-.39976E-07,
 * 2.7780,-.31913,.015316,-.42233E-03,.58495E-05,-.31497E-07,
 * 2.7890,-.32711,.016294,-.46757E-03,.67191E-05,-.37440E-07,
 * 2.7074,-.33131,.017616,-.53858E-03,.81740E-05,-.47780E-07,
 * 1.8692,-.27668,.017233,-.55828E-03,.87162E-05,-.51698E-07,
 * 1.8213,-.27205,.017030,-.55202E-03,.86254E-05,-.51144E-07,
 * 2.0142,-.29519,.018635,-.62161E-03,.99366E-05,-.59978E-07,
 * 2.0453,-.31062,.020485,-.70853E-03,.11621E-04,-.71569E-07,

BL300010
 BL300020
 BL300030
 BL300040
 BL300050
 BL300060
 BL300070
 BL300080
 BL300090
 BL300100
 BL300110
 BL300120
 BL300130
 BL300140
 BL300150
 BL300160
 BL300170
 BL300180
 BL300190
 BL300200
 BL300210
 BL300220
 BL300230
 BL300240
 BL300250
 BL300260
 BL300270
 BL300280
 BL300290
 BL300300
 BL300310
 BL300320
 BL300330
 BL300340
 BL300350
 BL300360
 BL300370
 BL300380
 BL300390
 BL300400

1

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE.

* 2.3157,--34115,--020945,--66589E-03,10223E-04,--59827E-07,
 * 2.5752,--72889,018975,--62626E-03,10092E-04,--61273E-07,
 * 2.6845,--33282,017628,--52412E-03,77222E-05,--43702E-07,
 * 2.1549,--32912,021011,--68906E-03,10839E-04,--64712E-07,
 * 2.5456,--36285,023277,--61504E-03,13623E-04,--85591E-07,
 * 2.8393,--36876,021078,--67644E-03,10627E-04,--63641E-07,
 * 2.4875,--39156,027072,--97618E-03,16527E-04,--1.0432E-07/
 C
 C**NOX SPEED CORRECTION FACTOR COEFFICIENTS
 DATA AIN3/
 * 2.4442,--250110,1.3629E-02,--28703E-03,20758E-05,0.0,
 * 1.6263,--118300,65497E-02,--13714E-03,10085E-05,0.0,
 * 1.1265,--039340,26864E-02,--60802E-04,47729E-06,0.0,
 * 1.2268,--04449,26248E-02,--56715E-04,43426E-06,0.0,
 * 1.0174,--011896,91437E-03,--21574E-04,12230E-06,0.0,
 * 98760,--019567,16964E-02,--40400E-04,2800E-06,0.0,
 * 1.1592,--044454,29643E-02,--66299E-04,52236E-06,0.0,
 * 1.8866,--161290,90499E-02,--18561E-03,13256E-05,0.0,
 * 1.5578,--113030,67193E-02,--14341E-03,10608E-05,0.0,
 * 2.0452,--194010,11074E-01,--23175E-03,16837E-05,0.0,
 * 1.6326,--121860,70302E-02,--14629E-03,10614E-05,0.0,
 * 1.4482,--122440,70502E-02,--17108E-03,12578E-05,0.0,
 * 24597,084195,--34084E-02,--62988E-04,--41397E-06,0.0,
 * 1.2817,--080487,53574E-02,--11289E-03,0106E-06,0.0,
 * 1.5345,--125670,78594E-02,--16943E-03,12549E-05,0.0,
 * 70481,038153,--17391E-02,32614E-04,--20385E-06,0.0,
 * 78384,32855E-07,10603E-02,--31935E-04,29030E-06,0.0,
 * 94213,--042324,38625E-02,--93985E-04,75388E-06,0.0,
 C
 END

ENVIRONMENTAL PROTECTION AGENCY

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE.

FLOCK DATA

ENVIRONMENTAL PROTECTION AGENCY

COMMON/MYMCOR/MYR, MYR, TF
COMMON/MYMCOR/MYR, MYR, TF

REAL CORP.

```
C**DEFAULT MODAL SHAPE =
```

DATA MODAL SPLIT

C+ANNIA 15001

DATA M/M/ ACCUMULATION (DIVIDED BY 1000000)

C	C+VEHICLE REGISTRATION DISTRICT	DATE
*U159..0150..0.140..0.131..0.055..0.051..0.050..0.047..0.045..0.076..		
*U067..0.066..0.062..0.059..0.055..0.051..0.103..0.094..0.044..0.044..		
*U157..0.157..0.141..0.126..0.113..0.102..0.094..0.085..0.085..0.076..		
*U071..0.066..0.063..0.060..0.055..0.052..0.050..0.047..0.044..0.044..		
*U150..0.190..0.170..0.165..0.150..0.135..0.120..0.106..0.095..0.086..		
*U078..0.070..0.067..0.065..0.053..0.049..0.047..0.046..0.044..0.042..		
*U201..0.251..0.207..0.185..0.172..0.162..0.155..0.149..0.143..0.139..		
*U135..0.132..0.129..0.127..0.125..0.123..0.122..0.121..0.120..0.119..		

REGISTRATION DISTRIBUTIONS

[illegible]

BL40001
BL40002
BL40003
BL40004
BL40005
BL40006
BL40007
BL40008
BL40009
BL40010
BL40011
BL40012
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BL40040

A.

ASAP MODEL

CONFIDENTIAL

END

61400410

APPENDIX A. ENVIRONMENTAL PROTECTION AGENCY

COMPUTER PROGRAM SOURCE CODE

ISMAP MODEL

* 3.58	4.43	2.08	2.42	1.50	0.29	0.0	0.0	0.0	0.0	BL500810
* 4.45	2.43	1.11	0.94	0.31	0.31	0.0	0.0	0.0	0.0	BL500820
* 68.30	31.14	16.10	14.50	3.87	3.87	0.0	0.0	0.0	0.0	BL500830
* 3.58	4.43	2.08	2.45	1.73	0.41	0.0	0.0	0.0	0.0	BL500840
* 5.09	2.90	0.64	0.31	0.31	0.31	0.0	0.0	0.0	0.0	BL500850
* 78.70	32.40	14.50	3.87	3.87	3.87	0.0	0.0	0.0	0.0	BL500860
* 6.49	5.04	1.73	0.41	0.41	0.41	0.0	0.0	0.0	0.0	BL500870
* 23.90	18.54	22.02	5.22	1.46	1.46	0.0	0.0	0.0	0.0	BL500880
* 272.90	212.70	218.80	191.90	15.38	15.38	0.0	0.0	0.0	0.0	BL500890
* 8.80	12.80	10.50	9.10	3.99	3.99	0.0	0.0	0.0	0.0	BL500900
* 4.30	4.50	4.50	2.65	2.85	2.85	0.0	0.0	0.0	0.0	BL500910
* 35.10	27.00	27.00	27.00	27.00	27.00	0.0	0.0	0.0	0.0	BL500920
* 21.40	20.10	19.00	5.35	5.35	5.35	0.0	0.0	0.0	0.0	BL500930
* 8.96	4.70	3.82	0.29	0.0	0.0	0.0	0.0	0.0	0.0	BL500940
* 34.40	20.27	14.86	2.71	0.0	0.0	0.0	0.0	0.0	0.0	BL500950
* 0.14	0.28	0.56	0.04	0.0	0.0	0.0	0.0	0.0	0.0	BL500960
										BL500970
										BL500980
										BL500990
										BL501000
										BL501010
										BL501020
										BL501030
										BL501040
										BL501050
										BL501060
										BL501070
										BL501080
										BL501090
										BL501100
										BL501110
										BL501120
										BL501130
										BL501140
										BL501150
										BL501160
										BL501170
										BL501180
										BL501190
										BL501200

C ***EXHAUST EMISSION FACTOR INTERCEPT: CALIFORNIA

DATA BASECA/

* 4.45	2.00	0.29	0.15	0.15	0.15	0.0	0.0	0.0	0.0	0.0
* 68.30	30.42	3.60	3.80	3.00	3.00	0.0	0.0	0.0	0.0	0.0
* 3.58	3.52	3.12	1.50	1.10	0.29	0.21	0.0	0.0	0.0	0.0
* 4.45	2.43	1.11	0.29	0.15	0.15	0.0	0.0	0.0	0.0	0.0
* 68.30	31.14	16.10	13.70	3.80	3.80	0.0	0.0	0.0	0.0	0.0
* 3.58	4.43	2.08	1.50	1.28	0.54	0.21	0.0	0.0	0.0	0.0
* 5.09	2.90	0.29	0.16	0.16	0.16	0.0	0.0	0.0	0.0	0.0
* 78.70	32.40	13.70	3.80	3.80	3.80	0.0	0.0	0.0	0.0	0.0
* 6.49	5.04	1.73	0.44	0.44	0.44	0.0	0.0	0.0	0.0	0.0
* 23.90	18.54	22.02	18.16	5.22	3.50	1.46	0.0	0.0	0.0	0.0
* 272.90	212.70	218.80	209.00	191.90	15.38	15.38	0.0	0.0	0.0	0.0
* 8.80	12.80	10.50	7.50	2.04	6.20	3.99	0.0	0.0	0.0	0.0
* 4.30	4.50	4.50	2.65	2.85	2.85	2.85	0.0	0.0	0.0	0.0
* 35.10	27.00	27.00	27.00	27.00	27.00	27.00	0.0	0.0	0.0	0.0
* 21.40	20.10	18.61	16.30	5.35	5.35	5.35	0.0	0.0	0.0	0.0
* 8.96	4.70	3.82	0.82	0.29	0.29	0.29	0.0	0.0	0.0	0.0
* 34.40	20.27	14.86	2.71	2.71	2.71	2.71	0.0	0.0	0.0	0.0
* 0.14	0.28	0.56	0.04	0.04	0.04	0.04	0.0	0.0	0.0	0.0

C ***EXHAUST EMISSION FACTOR INTERCEPT: HIGH ALTITUDE

DATA BASEHI/

* 6.03.	4.07.	1.53.	0.70.	1.53.	0.21.	0.21.	0.13.	0.13.	0.13.	EL501210
* 110.04.	76.73.	38.31.	10.30.	38.31.	6.18.	2.88.	1.40.	1.40.	1.40.	EL501220
* 1.96.	3.00.	1.94.	1.50.	1.90.	1.50.	0.93.	0.18.	0.29.	0.29.	BL501230
* 6.03.	4.07.	1.79.	1.11.	1.79.	1.52.	0.47.	0.31.	0.0.	0.0.	BL501240
* 110.04.	76.73.	33.15.	16.10.	33.15.	29.90.	8.00.	3.87.	0.0.	0.0.	BL501250
* 1.96.	3.00.	1.94.	1.52.	2.45.	1.52.	1.07.	1.73.	0.41.	0.0.	BL501260
* 8.12.	4.86.	1.52.	0.47.	0.31.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501270
* 127.30.	79.90.	26.90.	8.00.	3.87.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501280
* 3.55.	3.41.	1.07.	1.73.	0.41.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501290
* 32.40.	31.05.	36.77.	8.74.	2.35.	1.46.	0.0.	0.0.	0.0.	0.0.	BL501300
* 441.50.	344.20.	357.20.	310.90.	31.70.	15.38.	0.0.	0.0.	0.0.	0.0.	BL501310
* 4.82.	8.67.	6.84.	5.92.	5.64.	3.99.	0.0.	0.0.	0.0.	0.0.	BL501320
* 5.80.	6.10.	6.10.	3.65.	2.85.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501330
* 56.80.	43.70.	43.70.	43.70.	27.00.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501340
* 11.80.	13.10.	12.90.	5.35.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501350
* 12.10.	7.97.	6.78.	0.45.	0.29.	0.29.	0.29.	0.29.	0.29.	0.29.	BL501360
* 47.10.	27.80.	20.40.	5.58.	2.71.	2.71.	2.71.	2.71.	2.71.	2.71.	BL501370
* 0.08.	0.18.	0.36.	0.03.	0.04.	0.04.	0.04.	0.04.	0.04.	0.04.	BL501380

C

C**EXHAUST EMISSION FACTOR SLOPE: 49 STATE

DATA DEL49/

* 0.58.	0.53.	0.27.	0.23.	0.23.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501390
* 3.06.	6.15.	2.80.	2.30.	2.00.	2.00.	0.0.	0.0.	0.0.	0.0.	BL501400
* 0.0.	0.0.	0.0.	0.0.	0.16.	0.22.	0.0.	0.0.	0.0.	0.0.	BL501410
* 0.58.	0.53.	0.41.	0.41.	0.23.	0.23.	0.0.	0.0.	0.0.	0.0.	BL501420
* 3.06.	6.15.	5.34.	5.34.	2.00.	2.00.	0.0.	0.0.	0.0.	0.0.	BL501430
* 0.0.	0.0.	0.0.	0.0.	0.11.	0.22.	0.0.	0.0.	0.0.	0.0.	BL501440
* 0.58.	0.53.	0.41.	0.23.	0.23.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501450
* 3.06.	6.15.	5.34.	2.00.	2.00.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501460
* 0.0.	0.0.	0.11.	0.22.	0.22.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501470
* 0.58.	0.53.	0.53.	0.53.	1.06.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501480
* 3.06.	6.15.	6.15.	6.15.	10.54.	10.54.	0.0.	0.0.	0.0.	0.0.	BL501490
* 0.0.	0.0.	0.0.	0.0.	0.34.	0.34.	0.0.	0.0.	0.0.	0.0.	BL501500
* 0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	PL501510
* 0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501520
* 0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501530
* 0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501540
* 1.17.	1.03.	1.03.	0.23.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501550
* 1.54.	4.00.	4.00.	2.00.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501560
* 0.0.	0.0.	0.0.	0.22.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	BL501570
										BL501580
										BL501590
										BL501600

C

APPENDIX A.

ISMAP MODEL

COMPUTER PROGRAM SOURCE CODE

C**EXHAUST EMISSION FACTOR SLOPE: CALIFORNIA

BL501610
BL501620
BL501630
BL501640
BL501650
BL501660
BL501670
BL501680
BL501690
BL501700
BL501710
BL501720
BL501730
BL501740
BL501750
BL501760
BL501770
BL501780
BL501790
BL501800
BL501810
BL501820
BL501830
BL501840
BL501850
BL501860
BL501870
BL501880
BL501890
BL501900
BL501910
BL501920
BL501930
BL501940
BL501950
BL501960
BL501970
BL501980
BL501990
BL502000

DATA DELCA/	0.23	0.23	0.23	0.23	0.0	0.0	0.0	0.0	0.0
* 0.58, 0.70,	0.23	0.23	0.23	0.23	0.0	0.0	0.0	0.0	0.0
* 3.06, 6.40,	2.33	2.00	2.00	2.00	0.0	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.16	0.16	0.22	0.22	0.0	0.0	0.0	0.0
* 0.58, 0.53,	0.41	0.23	0.23	0.23	0.23	0.0	0.0	0.0	0.0
* 3.06, 6.15,	5.34	5.34	2.33	2.00	2.00	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.11	0.22	0.22	0.22	0.0	0.0	0.0	0.0
* 0.58, 0.53,	0.23	0.23	0.23	0.23	0.23	0.0	0.0	0.0	0.0
* 3.06, 6.15,	5.34	2.00	2.00	2.00	2.00	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.11	0.22	0.22	0.22	0.22	0.0	0.0	0.0	0.0
* 0.58, 0.53,	0.53	0.53	0.53	1.06	1.06	0.0	0.0	0.0	0.0
* 3.06, 6.15,	6.15	6.15	10.54	10.54	10.54	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.0	0.0	0.34	0.34	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* 0.58, 0.53,	0.53	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
* 3.06, 6.15,	6.15	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
* C.0, 0.0,	0.0	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22

C**EXHAUST EMISSION FACTOR SLOPE: HIGH ALTITUDE

DATA DELCA/	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
* 0.55, 0.55,	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
* 2.81, 4.24,	2.80	2.80	2.80	2.30	2.00	2.00	2.00	2.00	2.00
* 0.0, 0.0,	0.0	0.0	0.16	0.16	0.16	0.22	0.22	0.22	0.22
* 0.55, 0.55,	0.41	0.41	0.41	0.41	0.23	0.23	0.23	0.23	0.23
* 2.81, 4.24,	5.34	5.34	5.34	5.34	2.00	2.00	2.00	2.00	2.00
* 0.0, 0.0,	0.0	0.0	0.0	0.11	0.11	0.11	0.11	0.11	0.11
* 0.55, 0.55,	0.41	0.23	0.23	0.0	0.0	0.0	0.0	0.0	0.0
* 2.81, 4.24,	5.34	2.00	2.00	0.0	0.0	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.11	0.11	0.22	0.0	0.0	0.0	0.0	0.0	0.0
* 0.55, 0.55,	0.55	1.06	1.06	0.0	0.0	0.0	0.0	0.0	0.0
* 2.81, 4.24,	4.24	10.54	10.54	0.0	0.0	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.0	0.34	0.0	0.0	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* 0.0, 0.0,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* 0.55, 0.55,	0.55	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
* 2.81, 4.24,	4.24	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

COMPUTER PROGRAM SOURCE CODE

ADJMF MODEL

BL502010
BL502020
BL502030

* 0.0 , 0.0 , 0.0 , 0.22 , 0.22 , 0.22 , 0.22 , 0.22 , 0.22 , 0.22 /

END

ENVIRONMENTAL PROTECTION AGENCY

SOURCE CODE PAGE 214

A. ISMAP MODEL										COMPUTER PROGRAM SOURCE CODE									
C**IDLE EMISSION FACTOR INTERCEPT: HIGH ALTITUDE																			
DATA IDLBHI /																			
* 3.25.	0.71.	7.09.	0.12.	0.05.	0.03.	0.01.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 24.63.	15.70.	21.02.	4.40.	4.04.	0.32.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.02.	0.04.	0.02.	0.05.	0.05.	0.04.	0.03.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.50.	0.40.	0.40.	0.25.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 1.32.	0.66.	0.66.	0.66.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 1.11.	1.00.	0.93.	0.81.	0.27.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 3.46.	1.81.	1.48.	0.32.	0.11.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 11.57.	6.82.	5.00.	0.91.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.01.	0.02.	0.04.	0.01.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
C**IDLE EMISSION FACTOR INTERCEPT: HIGH ALTITUDE																			
DATA IDLBHI /																			
* 2.29.	1.04.	0.24.	0.17.	0.24.	0.05.	0.05.	0.03.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 20.70.	20.71.	4.48.	3.01.	4.48.	1.81.	0.84.	0.41.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.26.	0.19.	0.06.	0.06.	0.28.	0.06.	0.14.	0.02.	0.04.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 2.29.	1.04.	0.22.	0.28.	0.22.	0.36.	0.12.	0.08.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 20.70.	20.71.	5.60.	2.02.	5.60.	3.75.	1.01.	0.49.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.26.	0.19.	0.03.	0.04.	0.25.	0.04.	0.11.	0.18.	0.04.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 3.40.	3.50.	0.39.	0.12.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 38.84.	48.25.	3.75.	1.01.	0.49.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.10.	0.17.	0.11.	0.17.	0.04.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 4.46.	1.34.	5.82.	1.22.	0.32.	0.20.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 55.59.	40.68.	56.80.	71.15.	3.17.	1.54.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.01.	0.03.	0.02.	0.01.	0.01.	0.01.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.58.	0.75.	0.75.	0.34.	0.25.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 2.97.	1.71.	1.71.	1.71.	0.66.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.64.	0.64.	0.64.	0.27.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 4.01.	3.59.	2.27.	0.20.	0.13.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 26.07.	6.68.	4.90.	1.34.	0.65.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.01.	0.01.	0.03.	0.01.	0.04.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
C**IDLE EMISSION FACTOR SLOPE: 49 STATE																			
DATA IDLBHI /																			
* 0.18.	0.20.	0.07.	0.07.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 2.15.	2.92.	0.37.	0.67.	0.59.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.0.	0.0.	0.0.	0.03.	0.06.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.18.	0.20.	0.19.	0.19.	0.06.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 2.55.	2.92.	1.54.	1.56.	0.25.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.0.	0.0.	0.0.	0.02.	0.01.	0.02.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.
* 0.18.	0.20.	0.19.	0.01.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.	0.0.

ENVIRONMENTAL PROTECTION AGENCY

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DATA IDELCA/

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DATA IDELHI /

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* 0.0	0.0	0.0	0.07	0.02	0.02	0.01	0.01	0.01	0.02	0.0	BL601210
* 0.21	0.14	0.19	0.08	0.06	0.0	0.0	0.0	0.0	0.0	0.0	BL601220
* 0.57	1.15	1.56	0.25	0.25	0.0	0.0	0.0	0.0	0.0	0.0	BL601230
* 0.0	0.0	0.01	0.01	0.02	0.0	0.0	0.0	0.0	0.0	0.0	BL601240
* 0.21	0.14	0.14	0.20	0.40	0.40	0.0	0.0	0.0	0.0	0.0	BL601250
* 0.57	1.15	1.15	2.92	5.00	5.00	0.0	0.0	0.0	0.0	0.0	BL601260
* 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	BL601270
* 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	BL601280
* 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	BL601290
* 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	BL601300
* 0.36	0.62	0.62	0.10	0.10	0.0	0.0	0.0	0.0	0.0	0.0	BL601310
* 0.66	1.12	1.12	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	BL601320
* 0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	BL601330
											BL601340
											BL601350

END

PLCK	DATA	PCIMHN/	3,	6,11,15,	19,24,27,31,35,	39,41,42,	44,46,47,48,	49,51,
C	COMMON/JMCRD/PCIMHN,PCIMHY,PCIMCN,PCIMCY							
C	INTEGER PCIMHN(19,5,4),PCIMHY(19,5,4),PCIMCN(19,5,4),							
C	* FCIMCY(19,5,4)							
C	DATA PCIMHN/	3,	6,11,15,	19,24,27,31,35,	39,41,42,	44,46,47,48,	49,51,	
C	* 52,	4,	8,13,18,	22,28,34,36,40,42,45,46,49,50,	51,52,54,56,57,			
			7,14,20,28,34,39,43,46,49,52,54,55,57,58,	59,60,61,62,63,				
			8,15,22,30,36,41,46,49,52,54,56,58,59,61,	62,63,64,65,65,				
			8,16,23,31,37,42,46,50,53,55,57,59,60,61,	62,63,64,65,66,				
			4,	6,	9,11,16,19,20,27,29,30,32,33,35,36,37,38,			
			6,11,16,20,23,27,31,33,36,38,40,41,43,44,45,46,47,48,49,					
			10,18,24,28,33,36,40,42,45,47,48,50,51,53,55,55,57,58,					
			12,20,26,32,37,40,43,46,49,51,52,54,55,56,57,59,59,60,61,					
			13,22,28,34,39,43,46,49,51,54,55,57,58,59,61,61,62,63,64,					
			4,11,22,32,42,49,54,58,62,64,66,68,69,71,72,73,74,74,75,					
			4,13,25,37,46,53,58,62,65,67,69,71,72,73,74,75,76,77,77,					
			4,15,28,40,49,55,60,64,67,69,71,72,74,75,76,77,77,78,79,					
			5,17,31,47,51,53,63,66,69,71,73,74,75,76,77,78,79,79,80,					
			5,18,32,44,53,59,63,67,70,72,73,75,76,77,78,79,79,80,81,					
			3,	7,14,27,31,33,44,49,53,56,58,60,62,63,65,66,67,68,69,				
			3,	7,15,24,33,40,46,51,54,57,60,62,63,65,66,67,68,69,70,				
			3,	7,16,25,34,41,47,51,55,58,60,62,64,65,67,68,69,70,71,				
			3,	8,17,26,35,42,48,52,56,59,61,63,65,66,68,69,70,71,71,				
			3,	8,17,27,36,43,49,54,57,60,62,64,66,67,68,69,70,71,72/				
C	DATA PCIMHY/	6,13,17,20,25,32,35,40,45,47,49,50,53,53,54,56,57,57,						
C	* 5F,	9,14,19,25,31,36,43,45,50,51,53,54,55,56,58,61,63,63,						
		12,19,27,35,41,44,51,53,55,57,59,61,61,63,65,65,66,66,67,						
		13,24,33,40,46,50,54,57,59,61,63,65,65,66,68,68,69,70,71,						
		14,25,35,42,48,53,56,59,62,64,65,66,68,69,70,71,72,72,						
		9,13,15,18,22,26,31,33,35,37,39,40,42,44,44,44,46,48,						
		13,16,20,24,31,34,38,41,43,44,45,47,48,50,52,52,53,54,55,						
		14,21,28,33,37,41,45,47,50,52,53,54,56,57,59,60,61,61,62,						
		15,24,31,34,41,44,48,50,52,54,56,58,58,60,61,62,63,63,65,						
		16,26,33,39,43,47,50,53,55,57,59,60,61,63,64,65,65,66,67,						
		10,33,51,50,67,70,74,76,77,80,80,81,82,83,84,84,85,85,86,						


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*      32.45.50.54.57.60.63.64.65.67.68.69.70.71.72.72.73.73.74.
*      33.47.52.56.60.62.65.67.68.69.70.71.72.73.74.74.75.75.76.
*      5.24.40.48.56.60.65.67.69.72.72.74.75.76.77.78.78.79.79.
*      8.27.42.51.58.63.66.69.71.73.74.76.76.77.78.79.79.80.80.
*      11.29.43.52.59.64.67.70.72.74.75.76.77.78.79.80.81.81.
*      13.30.43.52.59.64.68.71.73.75.76.77.78.79.80.81.82.82.
*      14.30.43.52.59.64.68.71.73.75.76.77.78.79.80.81.81.82.82.
*      9.30.41.56.58.68.71.74.77.77.78.79.81.81.81.82.83.
*      15.37.51.60.66.70.72.76.77.78.80.82.82.82.83.84.85.85.
*      18.39.52.62.68.71.74.77.78.79.82.82.82.84.84.85.86.86.
*      21.43.57.66.71.75.76.80.81.83.84.85.85.86.86.87.87.88.88.
*      23.44.58.66.72.75.79.81.83.84.85.86.86.87.88.88.89.89/

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C

END

SECTION 8

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